Breezy Point and Neeld Estate Flood Mitigation Plan

December 31, 2016

Source: Maryland Department of Natural Resources Coastal Atlas
(http://gisapps.dnr.state.md.us/coastalatlas/WAB/index.html)

Prepared by Tay Harris and David Brownlee, PhD, AICP
Calvert County Department of Community Planning and Building

This product was prepared by Calvert County Government using federal funds under award number NA15NOS4190125 and NA15NOS4190165 from the Office of Ocean and Coastal Resource Management (OCRM), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. The statements, findings, conclusions and recommendations are those of the author(s) and do not necessarily reflect the views of NOAA or the U.S. Department of Commerce.

Table of Contents

Acronyms

BFE –Base Flood Elevation
BPNE FMP–Breezy Point and Neeld Estate Flood Mitigation Plan
BOCC–Board of County Commissioners of Calvert County
BRF–Bay Restoration Fund
CPB–Calvert County Department of Community Planning and Building
CPB ES–Calvert County Department of Community Planning & Building, Environmental Section
CRS–Community Rating System
DNR–Maryland Department of Natural Resources
DPW EH–Calvert County Department of Public Works, Engineering and Highways
DPS EMD–Calvert County Department of Public Safety, Emergency Management Division
FEMA–Federal Emergency Management Agency
FFD–Farm and Forest District
FIRM–Flood Insurance Rate Map
FMA–Flood Mitigation Assistance Program
FMP–Flood Mitigation Plan
FPE–Flood Protection Elevation
GIS–Geographic Information System
HMGP–Hazard Mitigation Grant Program
IDA–Intensely Developed Area, Critical Area Overlay Zone
LDA–Limited Development Area, Critical Area Overlay Zone
LiMWA–Limit of Moderate Wave Action
MCD–Marine Commercial District
MDE–Maryland Department of the Environment
MEMA–Maryland Emergency Management Agency
NFIP–National Floodplain Insurance Program
NOAA–National Oceanic and Atmospheric Administration
OCRM–Office of Ocean and Coastal Resource Management
PDM–Pre-Disaster Mitigation Program
RCA–Resource Conservation Area, Critical Area Overlay Zone
RCD–Rural Community District
RD–Residential District
RFC–Repetitive Flood Claims
RTEs–Rare, Threatened and Endangered Species
SBMA –Special Buffer Management Area
SRL–Severe Repetitive Loss Program
WD–Wetland District

Executive Summary

Breezy Point and Neeld Estate[1] are two communities adjacent to each other and located on the eastern shore of Calvert County along Plum Point Creek and the Chesapeake Bay. Breezy Point is Calvert County's seventh most flood-prone community with 23 flood-vulnerable structures and Neeld Estate is Calvert County's fifth most flood-vulnerable community with 45 flood-vulnerable structures. In both communities, several segments of roadways lying within the 100-year floodplain are also flood-vulnerable. Plum Point Creek and its associated tidal wetland also lie within the 100-year floodplain.

What is the 100-Year Floodplain?
The 100-year floodplain is an area that has a one percent annual chance of flooding to the base flood elevation during a 100-year flood.

To identify flood vulnerability in Breezy Point and Neeld Estate, Calvert County's Department of Community Planning and Building Environmental Section (CPB ES) worked in partnership with residents, Calvert County Departments of Public Works, Engineering and Highways (DPW EH), Calvert County Department of Public Safety, Emergency Management Division (DPS EMD) and a third party professional facilitator to compile and rank citizens' concerns to prepare the Breezy Point/Neeld Estate Flood Mitigation Plan (BPNE FMP). The BPNE FMP identifies flood issues, describes conditions contributing to flooding, and makes recommendations to mitigate flooding.

In addition, the BPNE FMP includes an inundation analysis, which takes into account land subsidence and possible sea level rise increases and the impacts of these occurrences on the Breezy Point and Neeld Estate communities. Mitigation recommendations are made under the following two scenarios: (1) a 2.1-foot rise in sea level resulting in a 2.1-foot increase in elevation of the 100-year floodplain by 2050 and (2) a 3.4-foot sea level rise resulting in a 3.4-foot increase in sea level by 2100, inundating up to 10-foot land elevations.

Under the scenario of a 2.1-foot rise in sea level by 2050, vulnerable structures could increase from 23 to 31 in Breezy Point and from 45 to 54 in Neeld Estate, increasing total vulnerable structures from 68 to 85. Under the scenario of a 3.4-foot rise in sea level by 2100, vulnerable structures could increase from 23 to 36 in Breezy Point and from 45 to 63 in Neeld Estate, increasing total vulnerable structures from 68 to 99. Several segments of roadways will also become vulnerable in both communities.

Flooding issues were identified and ranked by residents during a nominal group meeting facilitated by a third party consultant. These issues include: nuisance flooding associated with unmanaged stormwater; sewer service feasibility; Neeld Estate Beach erosion; potential costs to Neeld Estate property owners to address Neeld Estate Beach erosion; failed septic systems and inadequate lot sizes to accommodate septic systems; the rising sea level and associated rising tidal water; and lower property values due to flooding.

[1] Referred to as "Plum Point" in the 2011 Calvert County Flood Mitigation Plan.

Factors that contribute to flooding in Breezy Point and Neeld Estate are a high water table; low land elevations compared to base flood elevations (BFE), inadequate stormwater management; littoral drift and shoreline erosion; and the construction of homes prior to the County's 1984 initial implementation of flood regulations and the more stringent floodplain regulations adopted in 2011 and 2014.

What is Base Flood Elevation?
Base Flood Elevation is the anticipated flood level during a 100-year flood.

What is Littoral Drift?
Littoral Drift is the movement of sand along the shoreline due to currents and wave action.

Immediate and short term recommended actions include:

- Increase the freeboard requirement for new homes and substantial improvements to existing homes currently located in the 100-year floodplain from two feet to three feet above sea level to mitigate for the 2050 sea level rise scenario, to four feet above sea level to mitigate for the minimum 2100 sea rise level scenario or six feet above sea level to mitigate for the maximum 2100 sea level rise scenario;
- Address current flood threats by elevating structures or retreating (removing structures);
- Address stormwater management issues that contribute to flooding;
- Replace failing septic systems within the 100-year floodplain utilizing Bay Restoration Funds (BRF); and
- Pursue a shared community collection system to address septic system failures and for long-term sustainability.

What is Freeboard?
Freeboard is the required elevation of the first floor above the base flood elevation.

Long-term recommended actions into 2050 and 2100 include:

- Consider retreat to address flood threats into 2050 and beyond;
- If retreat is not the preferred option into 2050 and beyond, consider modifying existing shoreline erosion control measures, elevating roadways and utilizing amphibious homes and/or floating neighborhoods;
- Establish a threshold for which traditional flood mitigation measures (i.e., elevation of structures or retreat) are no longer considered adequate to address flooding issues; and
- Conduct outreach to elected officials and residents about increased flood-vulnerability and sea level rise.

What is Flood Protection Elevation?
The base flood elevation plus the freeboard equals the flood protection elevation.
Example: 4 BFE + two-foot freeboard = 6 FPE

In conclusion, Breezy Point and Neeld Estate are flood-vulnerable and will be increasingly vulnerable into the future. Increasing the required flood protection elevation (FPE), elevating structures and segments of roadways, addressing unmanaged stormwater, replacing failed septic systems with holding tanks or mound systems and

pursuing a shared community collection system for long-term sustainability can mitigate tidal and nuisance flooding at present and into the immediate future. However, if 2050 and 2100 sea level rise scenarios become a reality, the County and its residents may decide to plan now to mitigate for sea level rise scenarios. The County should consider increasing freeboard requirements from two feet to three feet above sea level to mitigate for the 2050 sea level rise scenario, four feet above sea level to mitigate for the minimum 2100 sea level rise scenario or six feet above sea level to mitigate for the maximum 2100 sea level rise scenario. Additionally, a shift from utilizing traditional to nontraditional flood mitigation measures will likely be needed. Instead of and/or in addition to elevating structures and roadways/segments of roadways, residents may want to consider retreat. If retreat is not the preferred option, the County and its residents may consider modifying existing shoreline erosion control measures/coastal armoring, elevating height of the land in combination with coastal armoring and/or utilizing amphibious homes and/or floating neighborhoods, if Breezy Point and Neeld Estate are to remain sustainable a projected fifty plus years out. Such considerations will impact public safety, infrastructure investments and sustainability. Funding and staff resources for mitigation measures will need to be identified.

Background

Countywide Flood Mitigation Planning

The County adopted its first countywide flood mitigation plan, *Flood Mitigation Plan, Calvert County, MD* (Countywide FMP) in 2011 to comply with the Disaster Mitigation Act of 2000 (Public Law 106-390). The Act requires local jurisdictions to prepare and adopt a hazard mitigation plan, which addresses flood mitigation as a condition for receiving pre-disaster mitigation grant assistance and hazard mitigation grant program assistance from the Federal Emergency Management Agency (FEMA). The purpose of the Countywide FMP is:

> ***To develop a flood mitigation plan to improve Calvert County's and its municipalities' resistance to floods by identifying actions to reduce the impact of floods to County residents and structures[2].***

The Countywide FMP identifies the County's most flood-prone communities: Cove Point (166 primary structures at risk), Broomes Island (71 primary structures at risk), the Town of Chesapeake Beach (70 primary structures at risk), the Town of North Beach (61 primary structures at risk), Breezy Point/Neeld Estate communities[1] and Long Beach. Preparing a flood mitigation plan for Breezy Point/Neeld Estate is part of the County's larger effort to write small flood mitigation plans for Calvert County's most flood-prone communities. This effort sprang from the findings and recommendations found in the Countywide FMP. In 2014, the Cove Point Community Flood Mitigation Plan was adopted. In 2017, the Broomes Island Flood Mitigation Plan was adopted. In 2016, the County began working with the Town of Chesapeake Beach, the County's third most flood-prone community (70 primary structures at risk) and the Town of North Beach, the County's fourth most flood-prone community (61 primary structures at

[2] Calvert County, MD, Flood Mitigation Plan (2011), p. 25. Breezy Point/Neeld Estate is referred to as "Plum Point" in the 2011 Calvert County Flood Mitigation Plan.

risk) to prepare a flood mitigation plan for the Towns. Additionally, the County is updating its Countywide FMP in 2016 and 2017 and will be preparing a flood mitigation plan for Solomons[3] in 2017. This plan, BPNE FMP, identifies flooding issues and recommends mitigation actions for the County's seventh and fifth most flood-vulnerable communities, Breezy Point (23 structures at risk) and Neeld Estate[4] (45 structures at risk), respectively.

Purpose and Objectives

The purpose of the BPNE FMP is:

> ***To develop a flood mitigation plan to improve Breezy Point's and Neeld Estate's resistance to flooding by identifying actions that reduce flood impacts to residents, structures and infrastructure; and by identifying projected impacts of sea level rise at 2050 and 2100.***

The objectives of the BPNE FMP are to:

- Identify flood issues specific to Breezy Point and Neeld Estate;
- Identify options to mitigate flooding in Breezy Point and Neeld Estate;
- Make recommendations to mitigate flooding in Breezy Point and Neeld Estate;
- Identify the implications of sea level rise in Breezy Point and Neeld Estate;
- Make short-term and long-term recommendations to mitigate potential sea level rise impacts to Breezy Point and Neeld Estate; and
- Serve as a planning tool to address flood issues in Breezy Point and Neeld Estate.

Planning Process

On May 16, 2015, CPB ES held a facilitated public meeting in Neeld Estate to discuss flood issues in Breezy Point and Neeld Estate. Forty-four residents from both communities and staff from Calvert County DPW EH and DPS EMD attended. The Department of Community Planning and Building Environmental Section prepared the BPNE FMP between June 2015 and December 2016 utilizing information gathered at the public meeting, information contained in the Calvert County FMP and consulting with Calvert County's DPW EH and DPS EMD. The Board of County Commissioners of Calvert County, Maryland (BOCC) reviewed the draft BPNE FMP on _____ __, 2017. CPB ES solicited comments from the County agencies, boards and commissions, residents, adjoining jurisdictions and state agencies through the State Clearinghouse review process from _____ __, 2017 to _____ __, 2017. Comments were incorporated into the BPNE FMP between _____ and ____ of 2017. A public hearing was held before the Planning Commission of Calvert County, MD (Planning Commission) on _____, 2017. The BOCC, having received the recommendation to approve the BPNE FMP from the Planning Commission, held a public hearing and approved the BPNE FMP on _____, 2017. Funding

[3] Solomons is not one of Calvert County's most flood-prone communities according to the Calvert County, MD Flood Mitigation Plan (2011). However, Solomons is one of Calvert County's repetitive loss areas. See page 19 of This plan for discussion of repetitive loss areas.
[4] Neeld Estate is referred to as Plum Point in the Countywide Flood Mitigation Plan.

for the BPNE FMP was provided through the Office of Ocean and Coastal Resource Management (OCRM), National Oceanic and Atmospheric Administration (NOAA), Grant # NA24NOS4190125 and NOAA, Grant # NA15NOS4190165 and administered through the Maryland Department of Natural Resources' (DNR) Chesapeake and Coastal Service's Coastal Communities Initiative Grant Program.

Participants

The BPNE FMP was a collaborative effort involving Breezy Point and Neeld Estate property owners, Calvert County CPB ES, Calvert County DPW EH, Calvert County DPS EMD and SynergyForces, LLC, a professional facilitator.

Study Area

For the purposes of the BPNE FMP, the study area is delineated by the Breezy Point and Neeld Estate subdivision boundaries (Figure 1). The Breezy Point community is comprised of homes, the Breezy Point Marina, the Breezy Point Campground and the Breezy Point Beach. It is delineated to the north by Breezy Point Road, Bayview Terrace and Tea House Lane; to the west by Scott Street and Highview Road; to the south by Plum Point Creek; and to the east by the Chesapeake Bay. The Neeld Estate community, comprised of homes and Neeld Estate Beach, is delineated to the north and west by Plum Point Creek; to the south by Cedar Drive; and to the east by the Chesapeake Bay. The study area is located in the State of Maryland's 12-digit watershed named Plum Point Creek, which drains into the 8-digit watershed of the West Chesapeake Bay Watershed.

Photograph 1: Plum Point Wharf
Source: http://www.neeldestate.com/old_photos.html

Photograph 2: Letchworth's Chance
Source:
http://www.sunspotsbonaire.com/familyquilt/chewcolonists.html

Breezy Point and Neeld Estate were historically referred to as Plum Point Landing, which served as a commercial port dating to the turn of the 19th century. In the 1750s, the Maryland General Assembly authorized the construction of a warehouse near present day Plum Point Road. By 1859, the Plum Point Wharf (Photograph 1), a steamboat terminal, the warehouse and a cannery were in operation accompanied by a nearby post office and general store. Letchworth's Chance (Photograph 2), a plantation built in 1680 and still standing today, is located adjacent to what was Plum Point Landing and is now near the entrance of Neeld Estate. Letchworth's Chance is considered to be one of the original Calvert County southern-style framed homes with a two-story double-parlor and is listed on Maryland Historical Trust's Inventory of Historical Places. Several outbuildings, open pastures, wooded areas and an orchard remain on the property today.

Figure 1: Breezy Point & Neeld Estate Study Area

Source: Calvert County Government

Zoning

Conventional Zones

Conventional zoning regulates the type and extent of land uses allowed in a particular zoning district. Development must comply with the conventional zoning that governs the land. Conventional zoning that governs Breezy Point and Neeld Estate (Figure 2) is described below.

- **Farm and Forest District (FFD)**-Allows for farms and forestlands with limited scattered residential development, with an emphasis on preserving farms with highly productive soils, environmentally sensitive lands, drinking water supplies, historic and scenic landscapes and lands in proximity to County Agricultural Preservation Districts. The FFD Zone corresponds with the mostly forested land west of Breezy Point and Neeld Estate.

- **Marine Commercial District (MCD)**-Allows for uses that cater to and serve marine activities. The MCD Zone corresponds with the Breezy Point Marina, the Breezy Point Campground and Breezy Point Beach.

- **Residential District (RD)**-Allows for residential development mixed with public buildings, schools, churches, public recreational facilities and accessory uses. The RD Zone corresponds with the Breezy Point and Neeld Estate residential development.

- **Rural Community District (RCD)**-Allows for a patchwork of residential single family homes, farms and forestlands and serves as a receiving area for development rights transferred from the Farm and Forest District. The RCD Zone designation governs open water associated with the Breezy Point Marina and adjacent wetland associated with the Plum Point Creek and the 100-year floodplain. Note: The RCD designation of open water and tidal wetland appears to be a zoning mistake and will be examined during the 2016-2017 Calvert County Comprehensive Plan update and Calvert County Zoning Ordinance rewrite.

- **Wetland District (WD)**-Tidal wetlands. The WD Zone corresponds with Plum Point Creek and its associated wetlands and 100-year floodplain. As noted above, there is a portion of the tidal wetland that is zoned RCD. This will be examined during the 2016-2017 Calvert County Comprehensive Plan update and Calvert County Zoning Ordinance rewrite.

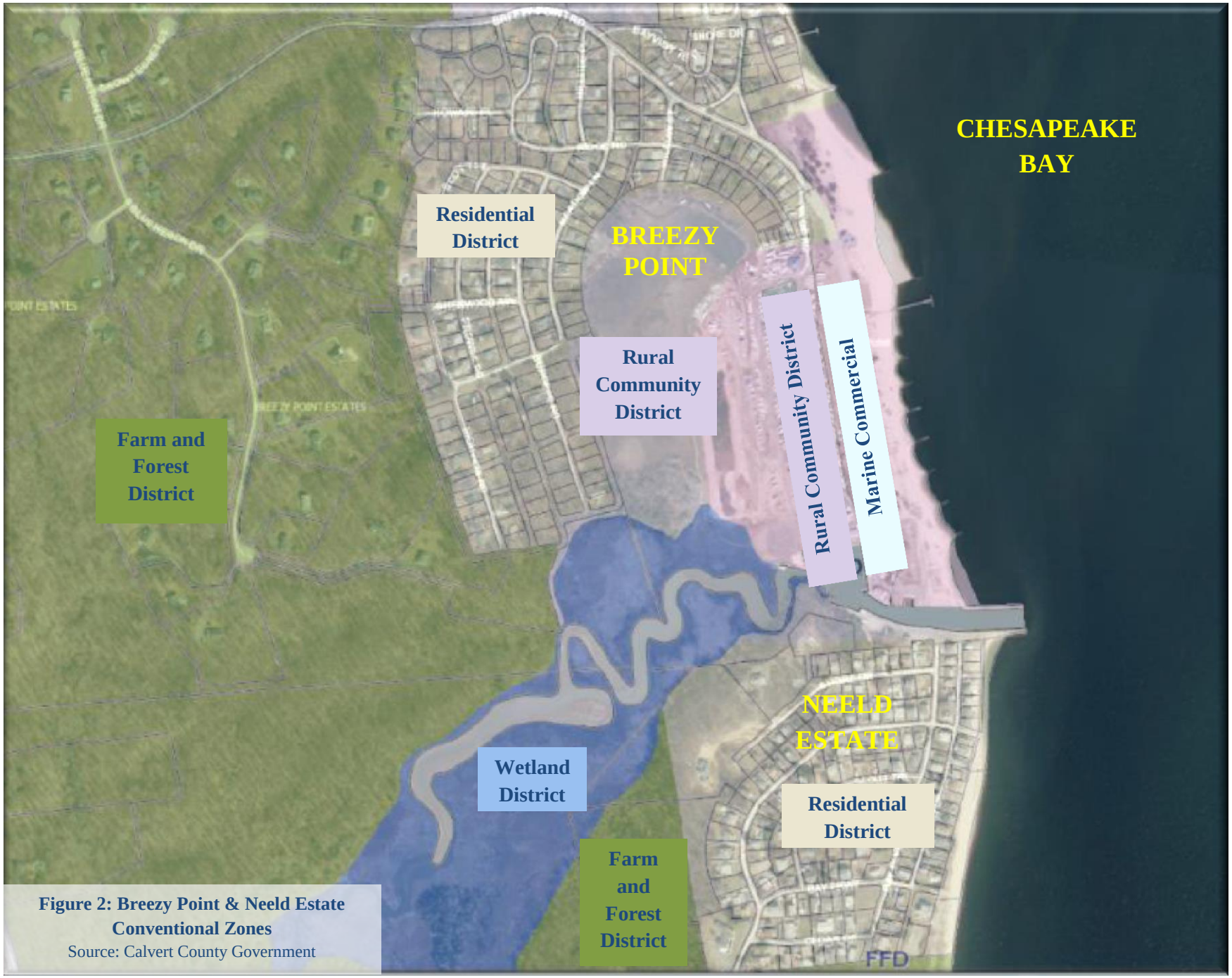


Figure 2: Breezy Point & Neeld Estate Conventional Zones
Source: Calvert County Government

Chesapeake Bay Critical Area Overlay Zones

Many of Breezy Point and Neeld Estate's properties are located in the Chesapeake Bay Critical Area and must comply with the Critical Area's overlay zones (Figure 3). Descriptions of the overlay zones governing Breezy Point and Neeld Estate are provided below.

- **Resource Conservation Areas (RCA)**-Areas within the Critical Area characterized by natural resources (e.g., wetlands, forests, abandoned fields, etc.) and resource utilization activities (e.g., agriculture, forestry, fisheries activity or aquaculture). In the study area, RCA overlays the steep slopes adjacent to Breezy Point and Neeld Estate and Plum Point Creek and the associated tidal wetland and 100-year floodplain.

- **Intensely Developed Areas (IDA)**-Areas within the Critical Area where future intense development activities shall be directed. In the study area, IDA overlays the Breezy Point Marina and Breezy Point Beach and Campground.

- **Limited Development Areas (LDA)**-Areas within the Critical Area where low or moderately intense development exists and animal and plant habitat areas coexist with development. In the study area, LDA overlays the residential development of Breezy Point and Neeld Estate.

- **Special Buffer Management Areas (SBMA)**-Areas designated by the local jurisdiction and approved by the Critical Area Commission where an exemption from certain portions of the 100-foot critical area buffer regulations may be granted. In order to designate these areas, the local jurisdiction must sufficiently demonstrate that the existing pattern of residential, industrial, commercial or recreational development in the Critical Area prevents the 100-foot critical area buffer from fulfilling its functions. If an exemption is granted, local jurisdictions shall propose other measures for achieving water quality and habitat protection objectives. These measures may include but are not limited to public education, stormwater management and urban forestry programs. In the study area, SBMA overlays the Breezy Point Marina, the Breezy Point Beach and the Breezy Point Campground.

Note: In 2015 and 2016, the Critical Area Commission revised the Critical Area map. Figure 3 shows the proposed Critical Area boundary and the expanded LDA.

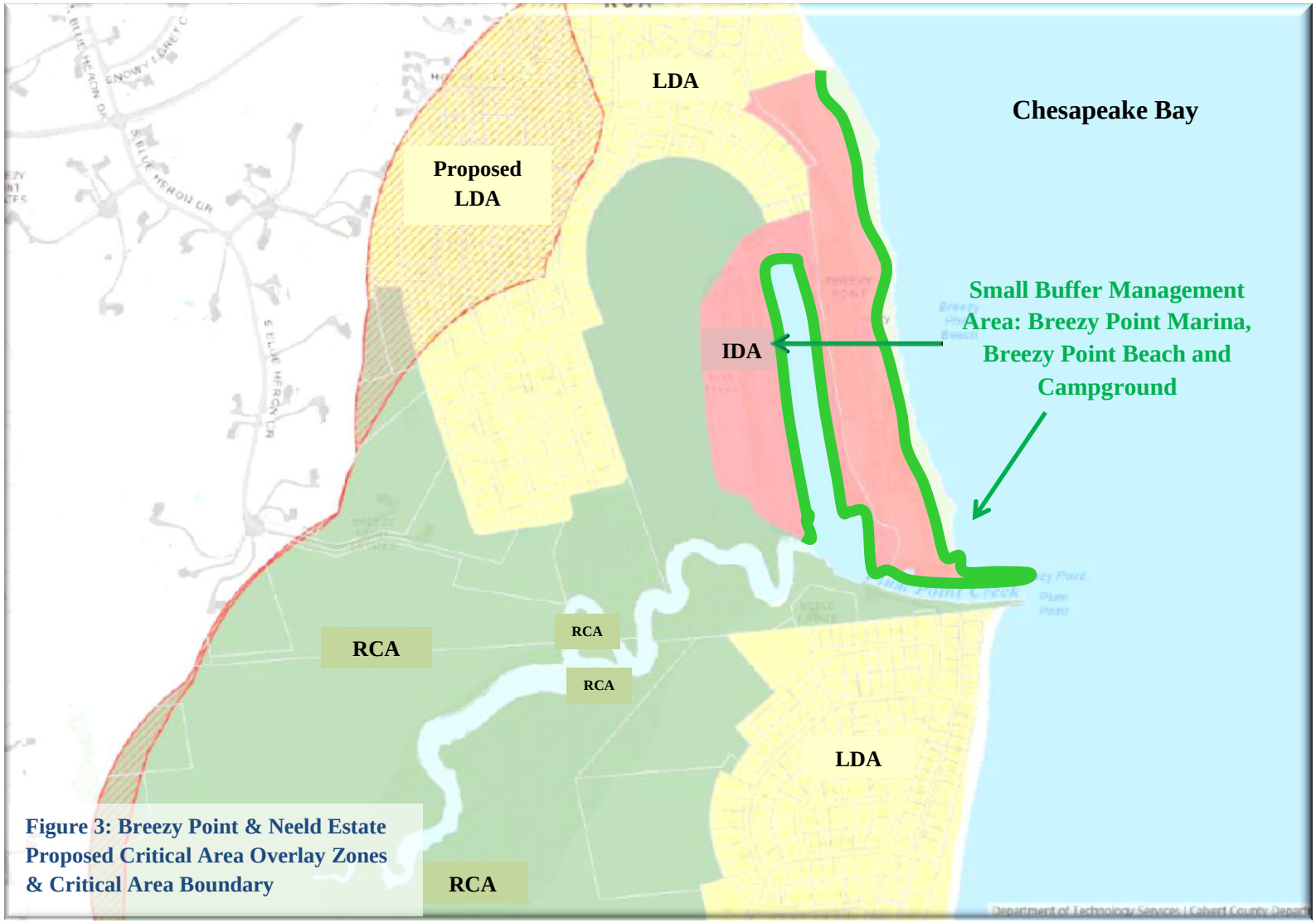


Figure 3: Breezy Point & Neeld Estate Proposed Critical Area Overlay Zones & Critical Area Boundary

Source: Calvert County Government

100-Year Floodplain

The 100-year floodplain has a one percent annual chance of flooding to the BFE and is broken into different "flood zones" based on established versus unestablished BFEs and wave action. Base flood elevations are anticipated floodwater depths during a base flood (100-year flood). Breezy Point and Neeld Estate's BFEs are four and five in the AE Zone and six in the VE Zone. The four, five and six BFEs generally mean "above sea level"[5] and are expressed by NAVD88, which is a system used by engineers and surveyors for relating ground and flood elevations[6]. BFEs governing a particular property may be found on Flood Insurance Rate Maps (FIRMs) and on the Calvert County website. The FIRMs delineate the 100-year floodplain, flood zones and BFEs.

What is a Flood Insurance Rate Map?
FIRMs are FEMA maps that delineate the 100-year floodplain.

The AE Zone overlays the majority of Breezy Point's and Neeld Estate's floodplain (depicted in pink in Figure 4) with the exception of the southern portion of Neeld Estate, which has an AO Zone (depicted in purple in Figure 4). The AO Zone is an area for which a BFE has not been established. The VE Zone represents potential 3-foot landward wave action with velocity (depicted in yellow in Figure 4). Delineated along the majority of the shoreline and on both sides of the Breezy Point Marina canal is the Limit of Moderate Wave Action (LiMWA), an area where wave action is anticipated and represents the approximate landward limit of a 1.5-foot breaking wave of the VE Zone (depicted with a line and triangles in Figure 4).

Tidal flood water enters both communities via the Chesapeake Bay with the potential to impact 23 structures in Breezy Point, 45 structures in Neeld Estate and several segments of roadways within both communities. Flood water also inundates the tidal wetland associated with Plum Point Creek, which also lies within the 100-year floodplain (Figure 5). The Breezy Point and Neeld Estate communities can experience extensive flooding during nor'easters, tropical storms and hurricanes and mild to moderate flooding during heavy/prolonged rains, especially during high tides. Additionally, stormwater flowing from the steep slopes west of both communities also contributes to flooding. Specific to Neeld Estate, tidal flooding comes from the Breezy Point Marina canal. During high tide, overflow from the canal makes its way onto and floods Beach Drive. Residents report that water pools from the Breezy Point Marina canal to the property located at 2813 Beach Drive. During extreme flood events, the entirety of Beach Drive floods. Additionally, a bulkhead was constructed from the Breezy Point canal to Lookout Trail in Neeld Estate to lessen wave action impacts onto the homes behind the bulkhead. While the bulkhead mitigates wave action, during severe weather events such as a nor'easter, tropical storm or hurricane, water flows over the bulkhead and through the opening of the bulkhead at the end of Ridge Road and to the lowest land elevations. The lowest land elevations are generally associated with the 100-year floodplain (Figure 4).

[5] In some areas' "above sea level" is determined by Lake Michigan.
[6] Source: http://www.fema.gov/media-library-data/e0431351fd0536694a66cef26268a694/440+NGVD-NAVD+5-09+508OK.pdf.

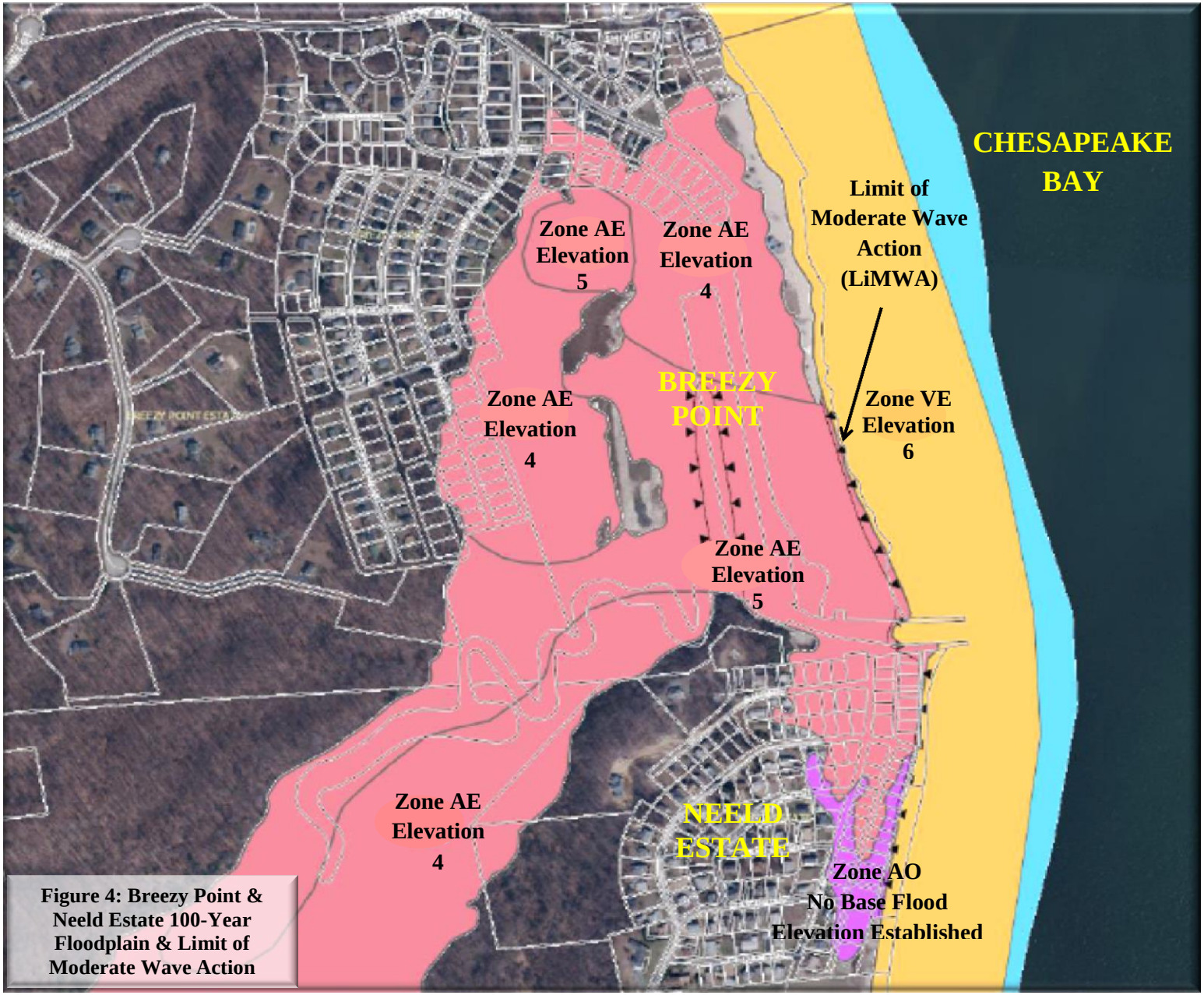


Figure 4: Breezy Point & Neeld Estate 100-Year Floodplain & Limit of Moderate Wave Action

Source: Calvert County Government

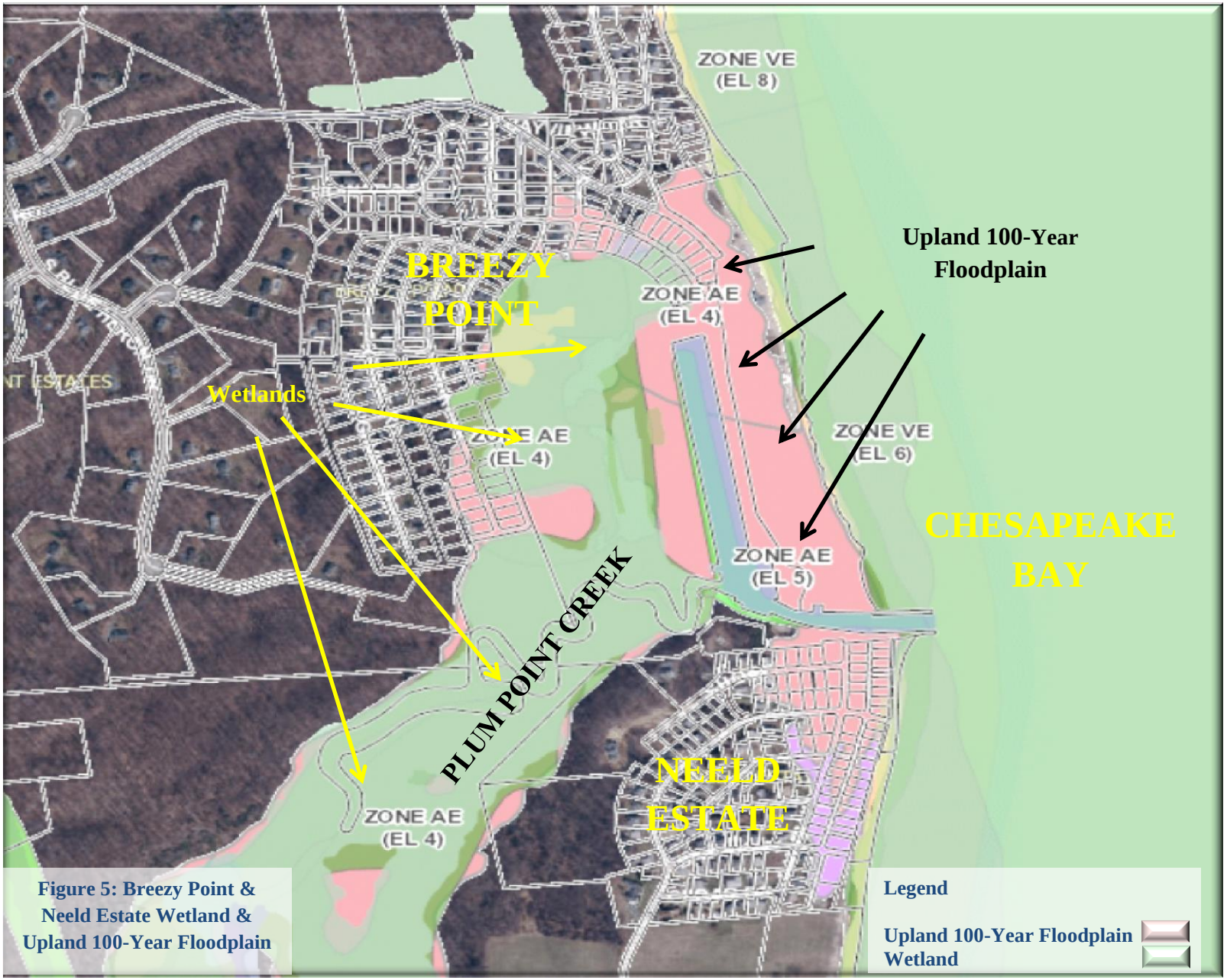


Figure 5: Breezy Point & Neeld Estate Wetland & Upland 100-Year Floodplain

Source: Calvert County Government

Flooding History

Over the years, Breezy Point and Neeld Estate have been impacted by nor'easters, tropical storms and hurricanes. In October of 1954, Hurricane Hazel increased tides six to eight feet higher than normal. In 1955, Hurricane Connie dumped 9.5 inches of rain on the County and caused above normal tides. In 1971 a severe thunderstorm caused flooding, power outages and road closings. In 1985, a severe thunderstorm brought rain, wind and high tides to the County where the low-lying lands within the floodplain received significant damage to homes and roads. In 1996, Hurricane Fran brought high winds and surging tides to the area. In 1998, the County was hit by two nor'easters within days of each other, causing widespread flooding, higher than normal tides, major shifting or pushing of beach sand and damage to roadways and homes. In 1999, Hurricane Floyd caused tidal flooding and strong winds, flooding homes two to four feet above sea level along the coast. In 2003, Hurricane Isabel caused a storm surge of five to nine feet above normal tide, flooding more than 100 homes throughout the County. In 2006, Tropical Storm Ernesto flooded areas of the County. Heavy rain/prolonged storms, coupled with high tide continue to flood the communities on a regular basis[7].

Photograph 3: Neeld Estate October 4th 2015

Photograph 4: Neeld Estate October 4th 2015

Photograph 5: Neeld Estate October 4th 2015

Source: Neeld Estate Residents

[7] 2011 Calvert County Flood Mitigation Plan, pp. 7-11.

Flooding Sources and Vulnerability Assessment

Contributing Factors

Contributing factors to Breezy Point and Neeld Estate's flooding vulnerability include:

- A high water table;
- Low land elevations compared to BFEs;
- Inadequate stormwater management to manage stormwater flowing from the steep slopes west of both communities;
- Littoral drift and shoreline erosion; and
- The building of homes prior to the County's 1984 initial implementation of flood regulations and the recently adopted 2011 and 2014 more stringent regulations.

Discussion of Contributing Factors

High Water Table, Low Land Elevations and Steep Slopes

The Breezy Point and Neeld Estate communities sit on a high water table. Additionally, the 100-year floodplain BFEs are four, five (AE Zone) and six (VE Zone) feet above sea level, which are in many instances higher than land elevations along the shoreline or adjacent to the shoreline and within the floodplain. This suggests land elevations of six feet or less flood during a 100-year storm. Factoring in wind and wave velocity, land elevations higher than six feet have potential to be flooded by storm surge. Furthermore, slopes 50 percent or more are sparsely scattered throughout both communities (Figure 6). Land elevations range from 110 feet west of Breezy Point to zero feet along the shoreline and 70 feet west of Neeld Estate to zero feet along the shoreline. Homes in the lower lying eastern portions of both communities are predominantly located on lands sloped 15 percent or less, resulting in nuisance flooding of these lands.

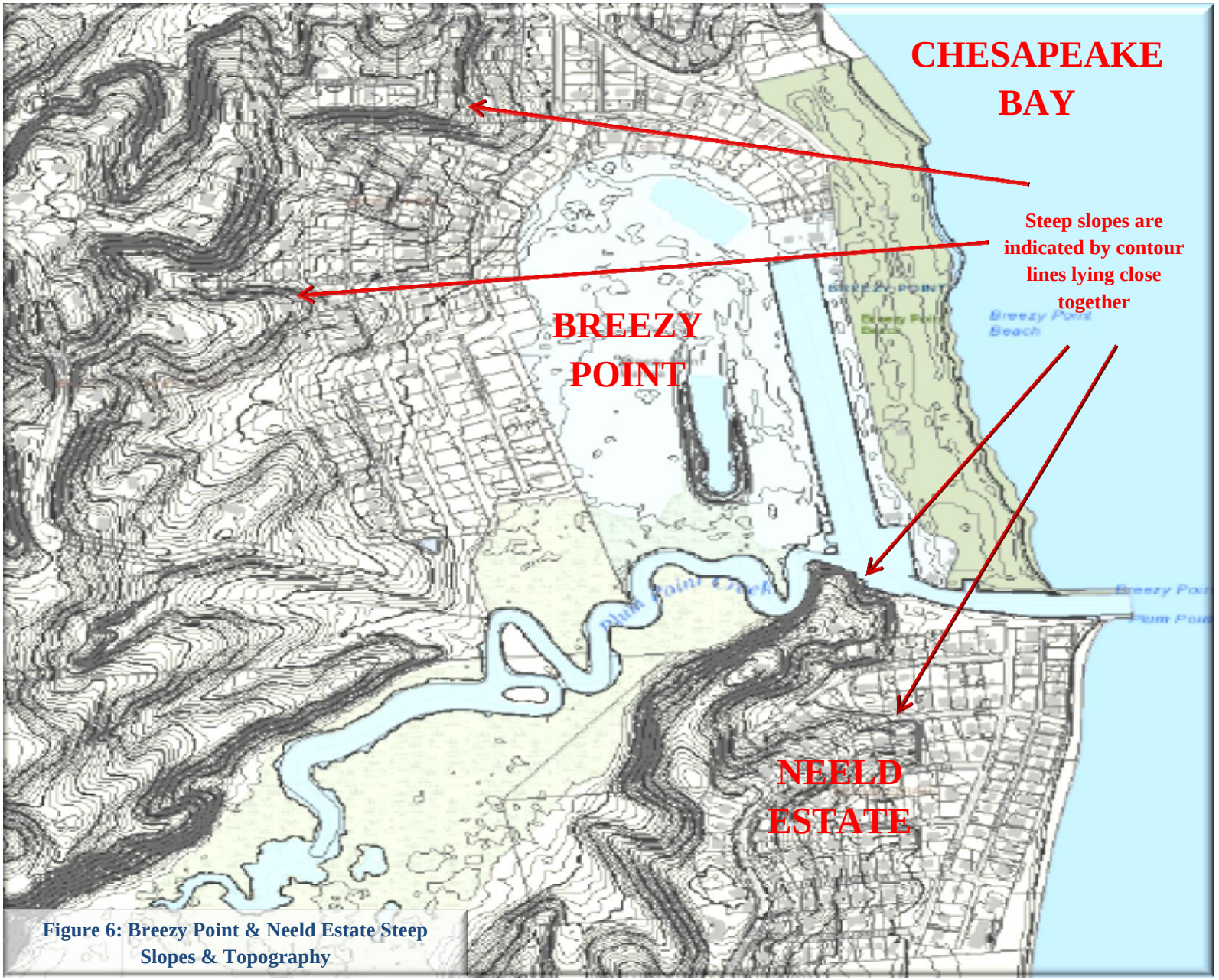


Figure 6: Breezy Point & Neeld Estate Steep Slopes & Topography

Source: Calvert County Government

Littoral Drift and Shoreline Erosion

According to DNR's Coastal Atlas, historically, erosion has occurred along Breezy Point's shoreline and accretion has occurred along Neeld Estate's shoreline (Figure 7).

What is accretion?
The gradual accumulation of sand along the shoreline.

However, today there are shoreline control measures to control dynamics along both Breezy Point's and Neeld Estate's shorelines. A groin field is located along Breezy Point Beach to minimize erosion.

Figure 7: Breezy Point & Neeld Estate Historic Shoreline Changes
Source: DNR Coastal Atlas (website source: http://gisapps.dnr.state.md.us/coastalatlas/WAB/index.html

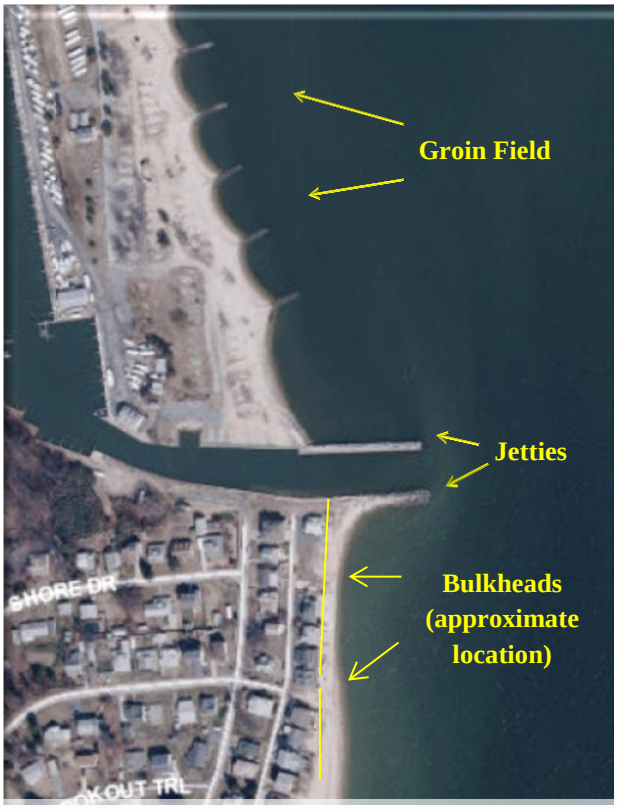


Figure 8: Groin Field, Jetties & Bulkhead in the Breezy Point & Neeld Estate
Source: Calvert County Government

Jetties have been placed on either side of the Breezy Point Marina canal entrance to minimize sedimentation of the canal. A bulkhead has been placed along the shoreline in Neeld Estate extending from the Breezy Point Marina canal to Lookout Trail to mitigate beach erosion and wave action. Breezy Point Beach is successfully protected by the groin field and the north jetty. The jetties at the entrance of the Breezy Point Marina have decreased the canal's sedimentation. The bulkhead retains sand between the bulkhead and shoreline houses (Figure 8). Through the processes of littoral drift and erosion, sand accretes and erodes on the "bayside' of the bulkhead based on weather conditions.

What is a groin field?
Groins are structures located perpendicular to the shore that reduce shoreline erosion.

Floodplain Regulations

Many structures in Breezy Point and Neeld Estate were built prior to the adoption of floodplain regulations. Over time floodplain regulations have become stricter. For example the law requires increased freeboard, first floor elevation above the BFE, elevation of outside air conditioning units, anchoring of fuel tanks, increased venting requirements, etc. In 2011 and 2014, Calvert County adopted new floodplain regulations which comply with FEMA's concurrent National Flood Insurance Program (NFIP) and the Maryland Department of Environment's (MDE)'s Maryland Model Floodplain Management Ordinance. These floodplain regulations are more stringent than those previously adopted, resulting in less flood vulnerability for new development and redevelopment over time. Examples of more stringent requirements include:

- Prohibition of structures in floodplain zones unless there is mitigation such as elevating the structure. Under previous regulations structures were allowed in the floodplain if the applicant could demonstrate no alternative, if the structure could withstand 100-year floodplain wind and waves, and if no sand dune system would be impacted.
- Requirement of two feet of freeboard above the BFE. Under previous regulations, one-foot of freeboard was required.

Vulnerability Assessment

According to the Countywide FMP, 68 structures are flood-vulnerable in Breezy Point and Neeld Estate. Table 1 provides a breakdown of the potential damage for the 68 structures based on a 100-year flood event.

Table 1: Calvert County Flood Mitigation Plan
Vulnerability Assessment of Breezy Point & Neeld Estate

Number of Structures	*Predicted Structure Damage*
Breezy Point	
6	0%-10%
17	11%-25%
Subtotal 23	
Neeld Estate	
7	0%-10%
24	11%-25%
14	26%-50%
Subtotal 45	
Total 68	

Source: Calvert County, MD Flood Mitigation Plan, 2011, p. 32.

Repetitive Loss Properties

Repetitive loss properties are strong indicators of flood-prone areas/properties in need of flood mitigation measures. Repetitive loss properties are insured properties for which owners have submitted two or more claims to FEMA and for which the NFIP has paid at least $1,000 to the homeowner within a 10-year period. According to FEMA's most recent data, there are five repetitive loss properties in Neeld Estate and zero in Breezy Point. More severe storm events such as a nor'easter, tropical storm or hurricane were likely the cause for the repetitive loss properties. It is also feasible that uninsured structures have flooded during more severe storm events, but claims were not filed.

Repetitive Loss Areas

Repetitive loss areas contain repetitive loss properties and the 100-year floodplain adjacent to a repetitive loss property. Under the County's Community Rating System (CRS, see below) participation, a portion of Neeld Estate has been identified as a repetitive loss area (Figure 9).

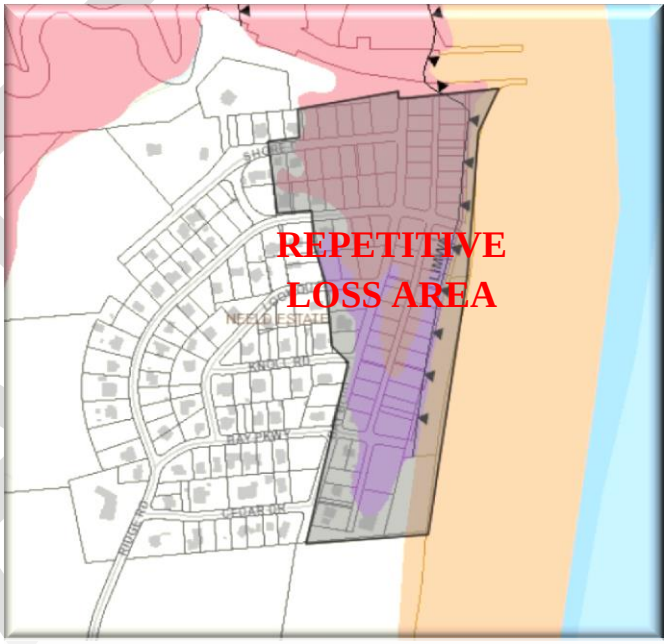


Figure 9: Community Rating System Repetitive Loss Area in Neeld Estate
Source: Calvert County Government

Community Rating System

The CRS program is FEMA's voluntary program aimed at lowering floodplain insurance premiums for property owners who own property within the 100-year floodplain. Premiums are lowered though a point system based upon the participating jurisdiction's flood management actions under the CRS program. FEMA approved the County's participation in the CRS Program at a level eight, resulting in a 10 percent reduction in residents' flood insurance premiums for structures located in a flood hazard area. The 10 percent premium reduction began for new or renewed polices on May 1, 2015. First floor of structures not elevated above the current BFE are considered noncompliant and ineligible for the CRS insurance premium reduction.

Calvert County participates in the CRS program through the following activities:

- Map Information Services: Calvert County has an interactive geographical information system (GIS) that depicts flood zones, LiMWA, flooding depths, etc.;
- Open Space and Preservation: Calvert County maintains an inventory of designated open space or preserved lands within the 100-year floodplain;
- Flood Management Planning: Calvert County has a current Countywide FMP complying with the Federal Hazard Act of 2000;

- Repetitive Loss Property Outreach: Calvert County provides outreach to property owners with properties located within repetitive loss areas; and
- Elevation Certification: The Calvert County Certified Floodplain Manager certifies that she/he reviews permits for compliance with the adopted Calvert County Floodplain regulations, and that elevation certificates are completed and kept on file when required for construction activities.

Sea Level Rise Scenarios

Sea Level Rise Scenarios for 2050 and 2100

While there is disagreement among scientists about what causes sea level rise, contributing factors have been attributed to man-induced global warming, natural geological and climate changes and land subsidence. Regardless of the cause, the primary impacts are evident–increased tidal and nuisance flooding, higher tides, increased storm surges, intensified coastal erosion, wetland inundation, salt water intrusion of wells and septic system failures. For property owners, tidal flooding and nuisance flooding present safety and property devaluation issues.

According to the Scientific and Technical Working Group of the Maryland Climate Change Commission in its 2013 report, "Updating Maryland's Sea Level Rise Projections," determining sea level rise in Maryland involves consideration of the following factors that are capable of producing a range of outcomes:

- The regional differences in sea level rise with regard to ocean dynamics associated with the decline in the strength of the Gulf Stream. It is uncertain as to whether the trends in the decline of the Gulf Stream will continue into the future and if other ocean dynamics play a role in sea level rise[8].
- Vertical land movement (land subsidence), which is determined by several complicated and variable factors. In addition, in Maryland, vertical land movement can be greatly influenced by sedimentation compaction and groundwater withdrawal effects[9].
- Changes in tidal range and storm surges due to inundation, which is influenced by water depth and the effect that water depth has on frictional resistance. Frictional resistance is lessened in deeper water, increasing the tidal range when the tide or a storm surge hits the shorelines[10].
- The increase in the global mean sea level rise, which is influenced by the expansion of ocean volume caused by the melting of the Greenland and Antarctic ice sheets. The rate at which these ice sheets melt and the distribution of this water influences global mean sea level rise[11].

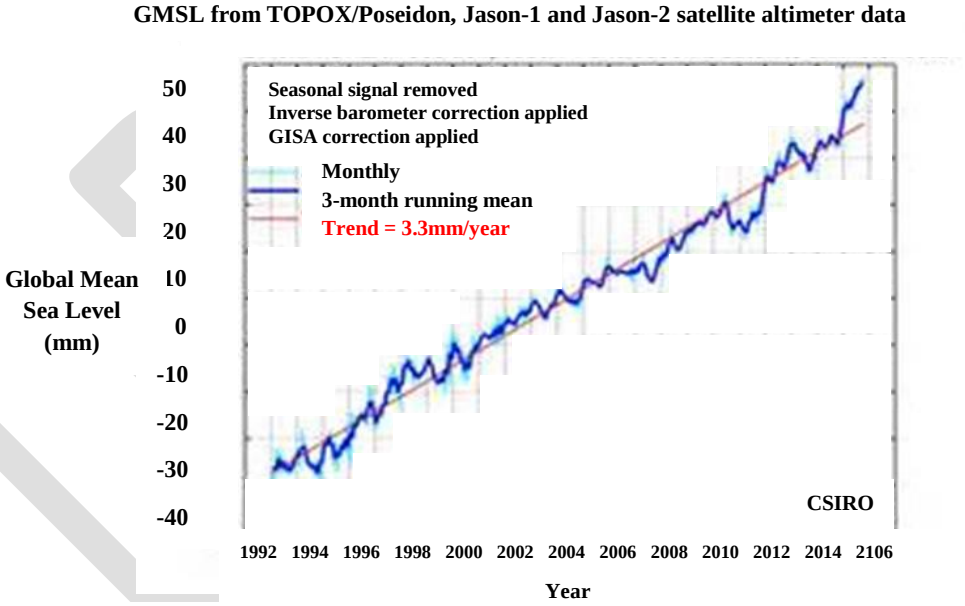
[8] Source: Updating Maryland's Sea Rise Projections (2013) p. 12 (website source: http://www.umces.edu/sites/default/files/pdfs/SeaLevelRiseProjections.pdf).
[9] Source: Updating Maryland's Sea Rise Projections (2013) p. 13 (website source: http://www.umces.edu/sites/default/files/pdfs/SeaLevelRiseProjections.pdf).
[10] Source: Updating Maryland's Sea Rise Projections (2013) p. 14 (website source: http://www.umces.edu/sites/default/files/pdfs/SeaLevelRiseProjections.pdf).

The report recommends planning for a relative sea level rise of 2.1 feet by 2050; 3.7 feet by 2100 (minimum 2100 scenario); and 5.7 feet by 2100 (maximum 210 scenario) if the built environment is to function beyond 2050 and/or 2100. Planning and mitigating for sea level rise is a locality's decision which should be based on the service goals and objectives for its infrastructure and public facilities, and the occurrence and flooding frequency of such infrastructure and public facilities. For example, SHA currently performs feasibility studies using a 2.1-foot increase in sea level rise by 2050 and a 5.7-foot sea level rise by 2100[12].

Sea Level Rise Scenarios and Shoreline Vulnerabilities

On the following pages is information about: global and East Coast sea level rise trends (Figures 10A and 10B); Calvert County's 2050 100-year floodplain scenario (Figures 11A and 11B); wetland migration scenarios (Figures 12A-12C); shoreline change scenarios (Figures 7 and 13); and storm surge (Figure 14).

Figure 10A: Global Sea Level Rise Trends Global Mean Sea Level Rise National Oceanic Atmospheric Administration



Source: Oceans and Atmosphere Flagship and the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC) (website source: http://www.cmar.csiro.au/sealevel/sl_hist_last_decades.html).

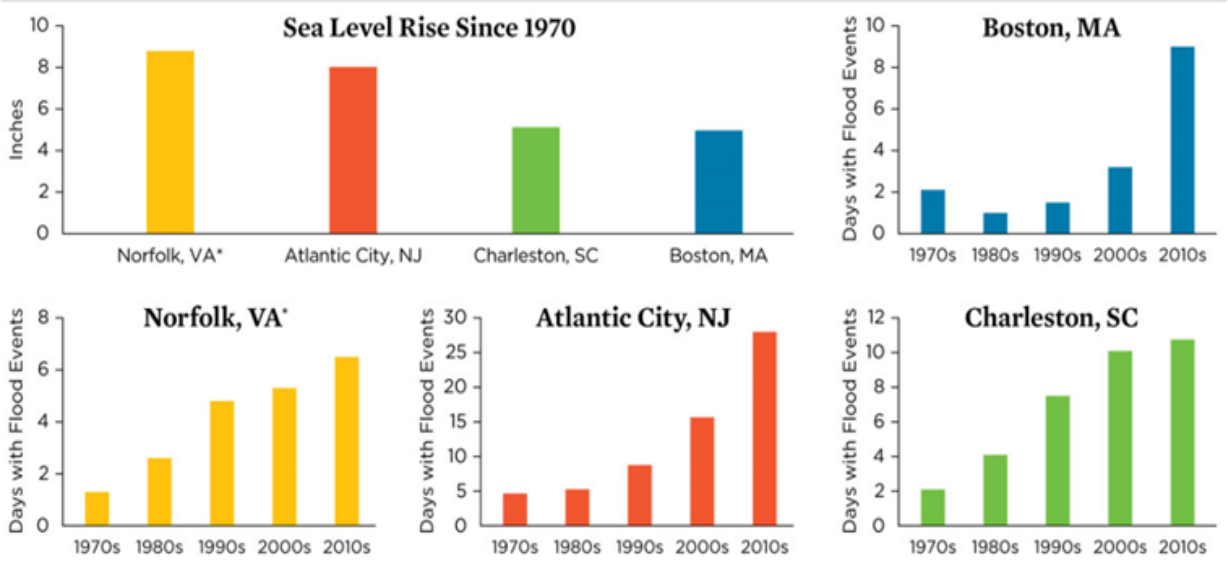
Global trends indicate that between 1993 and 2015, sea level rose 3.3 millimeters (mm) per year, which equates to 2.8 feet (Figure 10A).

[11] Source: Updating Maryland's Sea Rise Projections (2013) p. 15 (website source: http://www.umces.edu/sites/default/files/pdfs/SeaLevelRiseProjections.pdf).

[12] Source: A Maryland State Highway Administration letter dated February 22, 2016, concerning the elevation of a segment of MD 261 in North Beach.

Figure 10B: East Coast & Solomons Island Sea Level Rise Trends
National Oceanic Atmospheric Administration

Local Sea Rise and Tidal Flooding, 1970-2012

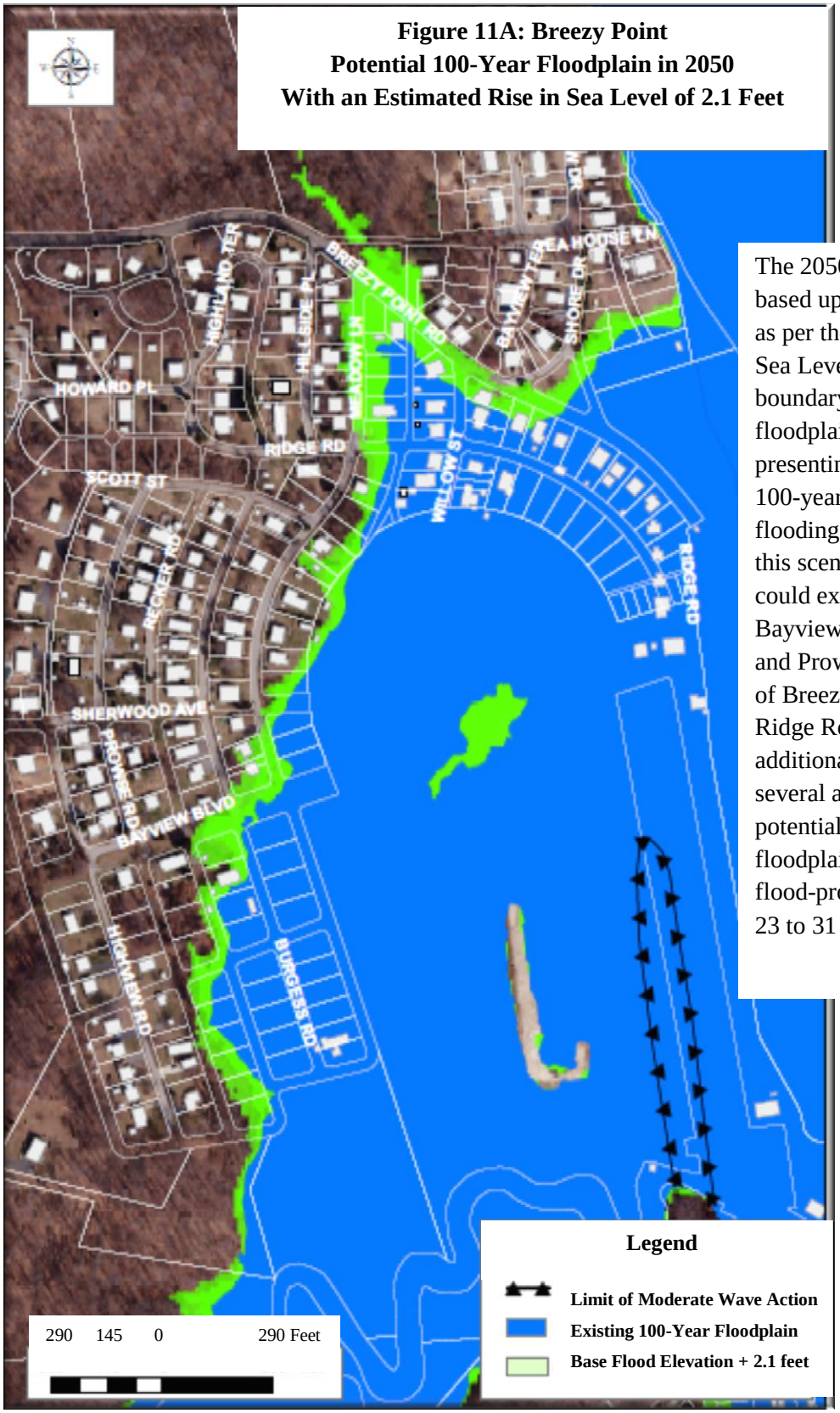


Source: Norfolk statistics recorded at Sewells Point tide gauge © Union of Concerned Scientists 2014 (website source: www.ucsusa.org/encroachingtides). Data sources: UCS ANALYSIS: MORALES AND ASHEIMER 2014: NOAA AND CURRENT 2014: NOAA TIDES AND CURRENTS 2013B.

According to NOAA, sea level has risen by about 3.5 inches globally–but more along the East Coast since 1970. At Sewells Point, VA, for example, sea level has raised more than eight inches, and in Boston, approximately five inches. Rising seas mean that communities up and down the East and Gulf Coasts are seeing more days with tidal flooding. Charleston, South Carolina, for example, faced two to three days with tidal flooding a year in the 1970s. The city now averages 10 or more such days annually. East Coast trends (Figure 10B) show an increase in local sea level rise, ranging from four plus inches to eight plus inches; and an increase in flood event days annually, ranging from a two-day increase in number to 10-day increase in Boston, Norfolk, Atlantic City and Charleston[13]. According to NOAA's data on sea level, Solomons Island has seen a 3.72 mm/year increase in sea level between 1937 and 2014, which equates to nearly one-foot in 78 years[14]. Trends indicate sea level rise will progressively increase over time.

[13] Source: Norfolk statistics recorded at Sewells Point tide gauge © Union of Concerned Scientists 2014 (website source: www.ucsusa.org/encroachingtides).
[14] Source: NOAA's Tides and Currents (website source: http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml).

Figure 11A: Breezy Point
Potential 100-Year Floodplain in 2050
With an Estimated Rise in Sea Level of 2.1 Feet



The 2050 sea level rise scenario is based upon a 2.1-foot rise in sea level as per the 2013 "Updating Maryland's Sea Level Rise Projections." The new boundary increases the 100-year floodplain elevation by 2.1 feet, presenting a potential increase in the 100-year floodplain and potential flooding in a 100-year flood. Under this scenario, the 100-year floodplain could expand to include portions of Bayview Boulevard, Meadow Lane and Prowse Road; and larger portions of Breezy Point Road, Burgess Road, Ridge Road and Willow Street. Eight additional primary structures and several accessory structures could potentially be located in the 100-year floodplain, increasing the number of flood-prone primary structures from 23 to 31 (Figure 11A).

Source: Calvert County Government

Figure 11B: Neeld Estate
Potential 100-Year Floodplain in 2050
With an Estimated Rise in Sea Level of 2.1 Feet

The 2050 sea level rise scenario is based upon a 2.1-foot rise in sea level as per the 2013 "Updating Maryland's Sea Level Rise Projections." The new boundary increases the 100-year floodplain elevation by 2.1 feet, presenting a potential increase in the 100-year floodplain and potential flooding in a 100-year flood. Under this scenario, the 100-year floodplain could expand to include portions of Bay Parkway, Cedar Drive and Knoll Road; and larger portions of Bay Boulevard, Beach Drive, Lookout Trail, Ridge Road and Shore Drive. Nine additional primary structures could potentially be located in the 100-year floodplain and several additional accessory structures increasing the number of flood-prone primary structures from 45 to 54 (Figure 11B).

Source: Calvert County Government

2100 Sea Level Rise Scenario with an Estimated 3.4-Foot Rise in Sea Level

The 2100 sea level rise scenario is based upon a 3.4-foot rise in sea level as per DNR's Coastal Atlas. At the time this Plan was written, DNR' Coastal Atlas reflects sea level rise scenarios presented in Maryland's 2008 Climate Action Plan[15]. Under the 2100 sea level rise scenario, vulnerable primary structures could increase from 23 to 36 primary structures in Breezy Point and from 45 to 63 primary structures in Neeld Estate. Total vulnerable primary structures could increase from 68 to 99 under the 2100. In Breezy Point, portions of Highview Road, Hillside Place and Shore Drive, and larger portions of Bayview Boulevard, Breezy Point Road, Burgess Road, Meadow Lane, Prowse Road, Ridge Road and Willow Street could experience severe flooding. In Neeld Estate, larger portions of Bay Boulevard, Bay Parkway, Beach Drive, Cedar Drive, Lookout Trail, Knoll Road, Ridge Road and Shore Drive could experience severe flooding.

Photograph 6: Neeld Estate October 4th 2015
Source: Neeld Estate Residents

Photograph 7: Neeld Estate October 4th 2015
Source: Neeld Estate Residents

[15] Source: Maryland's 2008 Climate Action Plan (2008) (website source: http://www.mde.state.md.us/programs/Air/ClimateChange/Pages/Air/climatechange/legislation/index.aspx).

Figure 12A: Breezy Point & Neeld Estate Current Wetlands

Figure 12A to the left shows wetlands in their current state (red and green).

Figure 12B below shows current and new wetlands by 2050 based upon a 1.3-foot rise in sea level (orange).

Figure 12B: Breezy Point & Neeld Estate New Wetlands by 2050 (assuming a 1.3-foot sea level rise)

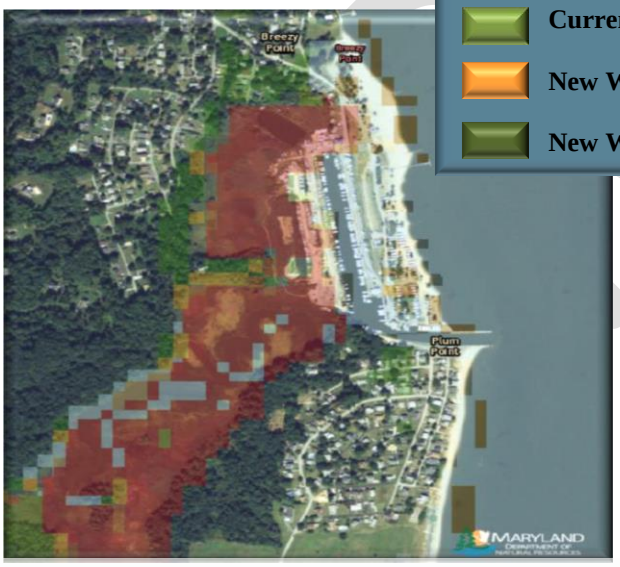


Figure 12C: Breezy Point & Neeld Estate New Wetlands by 2100 (assuming a 3.4-foot sea level rise)

Figure 12C, bottom left, shows current and new wetlands by 2100 based upon a 3.4-foot rise in sea level. The new wetlands can be seen in dark green.

If the 2100 sea level rise scenario (3.4 feet increase in sea level) is realized, all current and newly created wetlands could be under water.

Source: DNR Coastal Atlas (website source: http://gisapps.dnr.state.md.us/coastalatlas/WAB/index.html). DNR' Coastal Atlas reflects sea level rise scenarios presented in Maryland's 2008 Climate Action Plan.

Figure 7: Breezy Point & Neeld Estate: Historic Shoreline Changes (also on page 17)
Source: DNR Coastal Atlas (website source: http://gisapps.dnr.state.md.us/coastalatlas/WAB/index.html).

As discussed previously, historically, shoreline erosion has occurred along Breezy Point's shoreline and shoreline accretion has occurred along Neeld Estate's shoreline (Figure 7). Shoreline control measures have been constructed—a groin field is located along Breezy Point Beach to minimize erosion; jetties have been placed at the entrance of the Breezy Point Marina canal to minimize sedimentation of the canal; and a bulkhead has been placed along the shoreline in Neeld Estate extending from the Breezy Point Marina canal to Lookout Trail to mitigate beach erosion and wave action.

While historic shoreline changes show noticeable changes along both communities' shorelines over time, the rates of change along the Chesapeake Bay and Plum Point Creek are slight—less than a loss of two feet/year (Figure 13). Erosion rates are proportional to the length of the green and yellow lines, meaning that the erosion rate is determined by the length of the green and yellow lines divided by the number of years.

Figure 13: Breezy Point & Neeld Estate Shoreline Rates of Change
Source: DNR Coastal Atlas (website source: http://gisapps.dnr.state.md.us/coastalatlas/WAB/index.html).

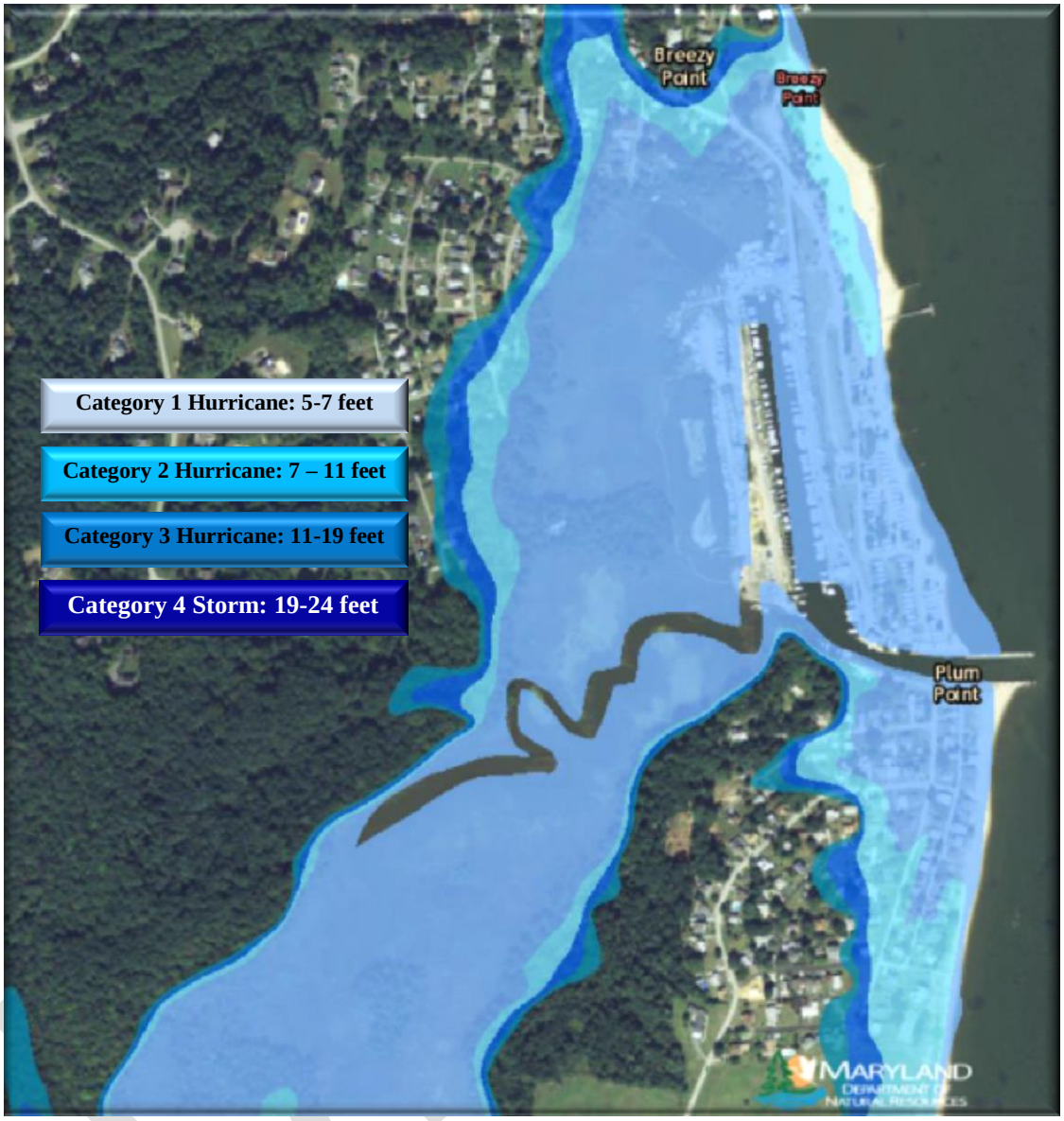


Figure 14: Breezy Point & Neeld Estate Storm Surge Vulnerability
Source: DNR Coastal Atlas (website source: http://gisapps.dnr.state.md.us/coastalatlas/WAB/index.html)

The Breezy Point and Neeld Estate Storm Surge Vulnerability Map (Figure 14) shows storm surges resulting from a Category 1 to a Category 4 hurricane. According to DNR's Coastal Atlas, Category 1–4 hurricane storm surges may flood Breezy Point Road, Ridge Road, Shore Drive, Meadow Lane, Burgess Road, Prowse Road, Highview Road, Hillside Place and Willow Street in Breezy Point; and Ridge Road, Shore Drive, Bay Boulevard, and Beach Drive in Neeld Estate.

What does all this mean to Breezy Point and Neeld Estate's flood vulnerability during a 100-year storm event in 2050? In 2100?

Comparing Calvert County's 2050 2.1-foot sea level rise scenario (Figures 11A & 11B) with the current 100-year floodplain boundaries (Figure 4), the 100-year floodplain in Breezy Point could expand to include portions of Bayview Boulevard, Meadow Lane and Prowse Road; and larger portions of Breezy Point Road, Burgess Road, Ridge Road and Willow Street. Eight additional primary structures and several accessory structures could potentially be located in the 100-year floodplain, increasing the number of flood-prone primary structures from 23 to 31 under the 2050 scenario. The 100-year floodplain in Neeld Estate could expand to include portions of Bay Parkway, Cedar Drive and Knoll Road; and larger portions of Bay Boulevard, Beach Drive, Lookout Trail, Ridge Road and Shore Drive. Nine additional primary structures could potentially be located in the 100-year floodplain and several additional accessory structures, increasing the number of flood-prone primary structures from 45 to 54 under the 2050 scenario. Total structures within the 100-year floodplain could increase from 68 to 85 by 2050.

Comparing DNR's Coastal Atlas's 2100 3.4-foot sea level rise scenario with current 100-year floodplain boundaries, in Breezy Point, the number of flood-prone primary structures could increase from 23 to 36 and portions of Highview Road, Hillside Place and Shore Drive, and larger portions of Bayview Boulevard, Breezy Point Road, Burgess Road, Meadow Lane, Prowse Road, Ridge Road and Willow Street may experience serious flooding. In Neeld Estate, the number of flood-prone primary structures could increase from 45 to 63 and larger portions of Bay Boulevard, Bay Parkway, Beach Drive, Cedar Drive, Lookout Trail, Knoll Road, Ridge Road and Shore Drive may experience serious flooding. Total flood-vulnerable structures could increase from 68 in total to 99 by 2100.

Sea Level Rise: Maryland's Climate Action Plan

The County may want to increase freeboard and FPEs to mitigate for the Maryland Commission on Climate Change's 2013 sea level rise scenarios: 2.1 feet (2050), 3.7 feet (2100 minimum) and/or 5.7 feet (2100 maximum). Below are Tables 2A-2C indicating the recommended increase in freeboard.

Table 2A: Breezy Point & Neeld Estate
Current Flood Protection Elevations & Potential Flood Protection Elevations
Factoring in the 2.1-Foot Rise Sea Level Rise by 2050

Current Base Flood Elevation (NAVD88)	*Current Flood Protection Elevation with Current Freeboard Requirement: 2 Feet (NAVD88)*	*Potential Base Flood Elevation with 2050 Increase in Sea Level: 2.1 Feet (NAVD88)*	*Recommended Freeboard Requirement for BFE of 4: 2050 Scenario (NAVD88)*	*Potential Flood Protection Elevation for BFE of 5: 2050 Scenario (NAVD88)*
AE 4	6	6.1	3	7
AE 5	7	7.1	3	8
VE 6	8	8.1	3	9

Table 2B: Breezy Point & Neeld Estate
Current Flood Protection Elevations & Potential Flood Protection Elevations
Factoring in the 3.7-Foot Rise Sea Level Rise by 2100

Current Base Flood Elevation (NAVD88)	*Current Flood Protection Elevation with Current Freeboard Requirement:2 Feet (NAVD88)*	*Potential Base Flood Elevation with 2100 Increase in Sea Level: 3.7 Feet (NAVD88)*	*Recommended Freeboard Requirement for BFE of 4: 2100 Scenario (NAVD88)*	*Potential Flood Protection Elevation for BFE of 5: 2100 Scenario (NAVD88)*
AE 4	6	7.7	4	8
AE 5	7	8.7	4	9
VE 6	8	9.7	4	10

Table 2C: Breezy Point & Neeld Estate
Current Flood Protection Elevations & Potential Flood Protection Elevations
Factoring in the 5.7-Foot Rise Sea Level Rise by 2100

Current Base Flood Elevation (NAVD88)	*Current Flood Protection Elevation with Current Freeboard Requirement: 2 Feet (NAVD88)*	*Potential Base Flood Elevation with 2100 Increase in Sea Level: 5.7 Feet (NAVD88)*	*Recommended Freeboard Requirement for BFE of 4: 2100 Scenario (NAVD88)*	*Potential Flood Protection Elevation for BFE of 5: 2100 Scenario (NAVD88)*
AE 4	6	9.7	6	10
AE 5	7	10.7	6	11
VE 6	8	11.7	6	12

Potential Mitigation Measures

In addition to increasing freeboard, options to mitigate flooding range in depth and scope, and may include but are not limited to barriers; coastal armoring; elevating the height of land in combination with coastal armoring; living shorelines; elevating residential structures; flood-proofing nonresidential and historic structures; demolishing structures and allowing the land to transition to its natural state; and floodable development including amphibious structures and floating neighborhoods.

Barriers

Storm surge barriers are placed at the mouth of a tidal waterway in an attempt to decrease the linear feet of shoreline needing flood protection. These barriers are typically large in scale and are not suitable for smaller communities such as Breezy Point or Neeld Estate. The Netherlands uses a storm surge barrier, the Maeslantkering, which is the largest in the world (Figure 15).

Figure 15: The Netherlands: Maeslantkering Storm Surge Barrier
Website source: https://en.wikipedia.org/wiki/Maeslantkering

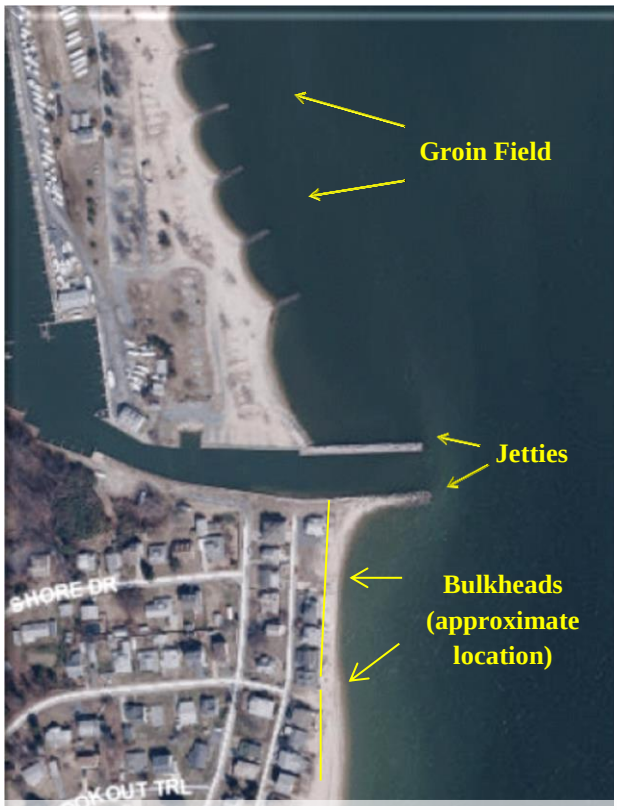


Figure 8: Groin Field, Jetties & Bulkhead in the Breezy Point and Neeld Estate (also no page 17)
Source: Calvert County Government

Coastal Armoring

Examples of coastal armoring include but are not limited to sea walls, levees, dikes and double dikes (the area between the dikes holds flood water), groins, bulkheads, revetments and jetties. As mentioned previously, a groin field is located along Breezy Point Beach to minimize beach erosion; jetties are located at the mouth of the Breezy Point Marina canal to minimize sedimentation of the canal; and a bulkhead is located along Neeld Estate's to minimize beach erosion and wave action (Figure 8).

Elevating Land in Combination with Coastal Armoring

Elevating the land in combination with coastal armoring is another option along the shoreline. Beach nourishment (i.e., creating dunes and beach replenishment) in combination with fill and elevating structures inland is an example of utilizing both techniques simultaneously. Fill is permitted under very limited circumstances per the County's floodplain regulations. Beach nourishment, if used as a means to mitigate flooding, needs to balance the need to replenish eroded beach areas with the need to preserve sensitive habitats and ecosystems. For example, in Cove Point, the County's most flood-prone community, there are natural resource lands such as tidal wetland, coastal barrier resources and sensitive species project review areas. In the Town of Chesapeake Beach, the County's third most flood-prone community, there is tidal wetland, a natural heritage area, a fish blockage location and sensitive species project review areas. In Breezy Point and Neeld Estate, there are tidal wetland and sensitive species project review areas.

Figure 16: Living Shoreline Measures at Jefferson Patterson Park and Museum

Source: http://www.jefpat.org/Documents/JPPM%20Living%20Shorelines%20Site%203.pdf

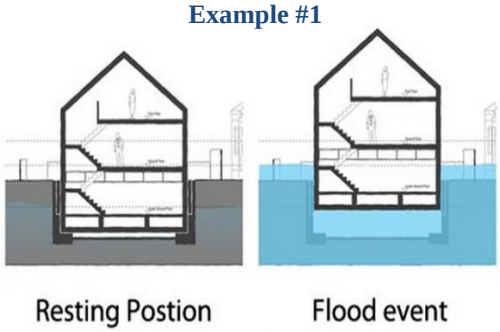
Living Shorelines

Living shorelines are shoreline measures typically constructed out of plants, stone, sand fill and other structural and organic materials. Living shorelines are designed to reduce wave energy, trap sediment and filter runoff while maintaining or increasing beach or habitat. The use of living shorelines as opposed to structural shoreline measures is preferred by DNR. Living shoreline measures have been used at the Jefferson Patterson Park and Museum in St. Leonard, MD (Figure 16). The living shoreline, as shown on Figure 16, is a segmented breakwater with marsh plantings shoreward of the breakwater and is built near and parallel to the shoreline to reduce wave energy on the land side of the structure. Living shorelines function more to stabilize shorelines, but in flood-prone areas with the right physical conditions, living shorelines can help control flood water by storing them and allowing a slow release back into the Chesapeake Bay, Patuxent River and/or groundwater.

Floodable Development including Amphibious Homes and Floating Neighborhoods

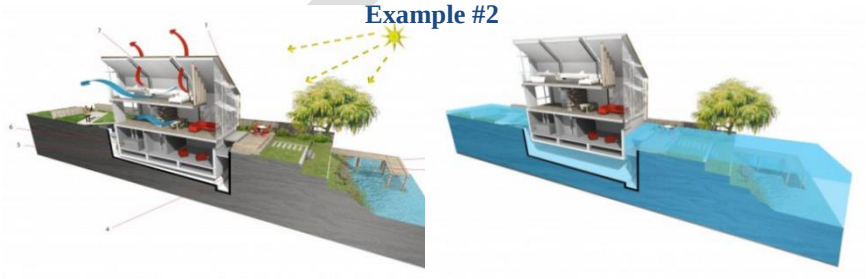
Floodable development techniques such as amphibious homes and floating neighborhoods may present feasible and preferable mitigation measures for flood-prone communities in the future. The Netherlands, with two-thirds of its land below sea level, is a leader in utilizing such techniques. Amphibious homes have concrete foundations anchored below the ground's surface and are designed to become buoyant when water rises, allowing the home to elevate with flood water. Once flood water recedes, the home lowers back into its resting place (Figures 17 and 18).

Figure 17: Amphibious Home Example #1



In an extreme flood the house can rise over 2.5 meters.

Figure 18: Amphibious Home Example #2

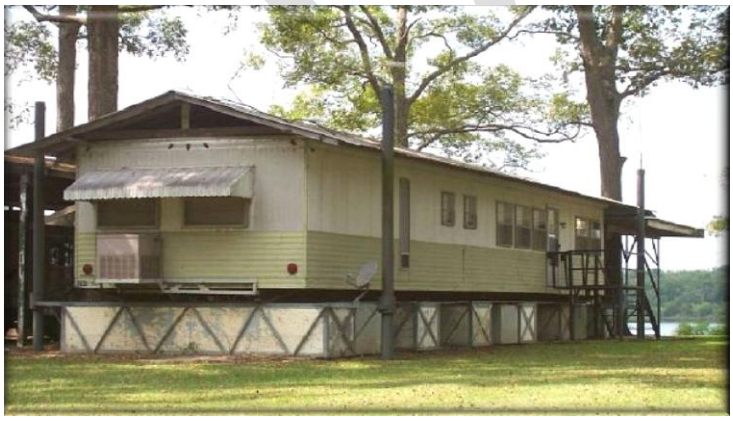


During a flood situation the entire building is designed to rise up in its dock and float there, remaining buoyed by the flood water.

Website source: http://thetechjournal.com/development/uks-first-amphibious-house-a-floating-pontoon.xhtml/attachment/uks-first-amphibious-house

The amphibious home concept is used for a home on the Mississippi River with foam blocks under the home and guideposts on each corner of the house to keep it anchored (Figure 19).

Figure 19: Amphibious Home Example #1



Source: http://www.inspirationgreen.com/floating-homes.html

Figure 20: Floating Neighborhood Example #1

Source: http://www.care2.com/causes/5-amphibious-houses-built-to-survive-the-coming-floods.html

Floating neighborhoods are another flood mitigation measure. Floating neighborhoods utilize boardwalks for sidewalks (Figure 20). The floating neighborhood in Figure 20 consists of 75 homes. If these mitigation measures are utilized policies and regulations for amphibious homes and floating neighborhoods need to be developed.

Elevating Residential Structures, Flood-proofing Nonresidential and Historic Structures and/or Demolishing Structures to Allow the Land to Transition Back to its Natural State

Elevating residential structures, flood-proofing nonresidential and historic structures and/or acquiring a property/demolishing a structure and allowing the land to transition back to its natural state are traditional flood mitigation approaches. Currently, the CPB ES is working with MEMA to administer FEMA flood mitigation grants to elevate three structures and acquire one property/demolish a structure and allow the land to transition back to its natural state. The grants were awarded from Hurricane Sandy Disaster Funds and were allocated to communities that were designated disaster areas after Hurricane Sandy. The County also submitted another FEMA pre-disaster flood mitigation grant application subsequently; however, FEMA did not award the grant to the County because FEMA's policy is to prioritize severe repetitive loss properties, of which there are none in Calvert County. It is possible that funding for these projects may become available due to the 2016 winter snow disaster declaration in Maryland.

MEMA offers financial assistance under its Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), Flood Mitigation Assistance Grant Program (FMA), Repetitive Flood Claims (RFC) and Severe Repetitive Loss Program (SRL). The FEMA grant assistance is a matching grant, requiring a non-federal/local 25 percent match to FEMA's 75 percent grant. Assistance to elevate or flood-proof requires the property owner to incur costs of an elevation certificate and assistance to demolish structures requires an appraisal for the application. The cost of the elevation certificate or appraisal qualifies as part of the 25 percent matching local funds. In addition, the property owner must obtain cost estimates for elevation or demolition for FEMA's grant assistance[16] (Table 3).

Table 3: Eligible Activities Under FEMA's Flood Mitigation Assistance Program	HMGP	PDM	FMA	RFC	SRL
Mitigation Projects					
Property Acquisition and Structure Demolition	√	√	√	√	√
Property Acquisition and Structure Relocation	√	√	√	√	√
Structure Elevation	√	√	√	√	√
Mitigation Reconstruction	√				
Dry Flood Proofing of Historic Residential Structures	√	√	√	√	√
Dry Flood Proofing of Nonresidential Structures	√	√	√	√	
Minor Localized Flood Reduction Projects	√	√	√	√	√
Structural Retrofitting of Existing Buildings	√	√			
Nonstructural Retrofitting of Existing Buildings and Facilities	√	√			
Safe Room Construction	√	√			
Infrastructure Retrofit	√	√			
Soil Stabilization	√	√			
Wildfire Mitigation	√	√			
Post-Disaster Code Enforcement	√				
5% Initiative Projects	√				
Management Costs	√	√	√	√	√

[16] For more information regarding these programs, go to FEMA's Hazard Mitigation webpage: http://www.fema.gov/hazard-mitigation-assistance.

Breezy Point and Neeld Estate Residents' Ranked Flooding Concerns

On May 17, 2014, CPB ES hosted a public meeting led by a professional facilitator. At this meeting Breezy Point and Neeld Estate residents identified and prioritized flooding concerns (Table 4).

Table 4: Breezy Point & Neeld Estate Residents' Ranked Flooding Concerns

Residents' Flooding Concerns – Ranked	*Points Given by Residents*
#1 Nuisance flooding associated with unmanaged stormwater	182
#2 Sewer service feasibility	167
#3 Neeld Estate Beach erosion	149
#4 Potential costs to Neeld Estate property owners to address Neeld Estate Beach erosion	125
#5 Sewer service-will it happen?	121
#6 Failed septic systems and inadequate lot sizes to accommodate septic systems	117
#7 Rising sea level and associated rising tidal water	89
#8 Lower property values due to flood vulnerability	86

Responses to Ranked Flooding Concerns of Breezy Point and Neeld Estate

#1 Nuisance flooding associated with unmanaged stormwater: Unmanaged stormwater flows from the steep slopes west of both Breezy Point and Neeld Estate and contributes to nuisance flooding. During the public meeting, residents reported unmanaged stormwater contributing to nuisance flooding, ranking this issue as the number one issue in both communities. CPB ES and DPW EH spoke with residents at the public meeting to gather input. In addition, CPB ES and DPW EH met with residents who expressed an interest to meet on-site. Below is a summary of the reported nuisance flooding issues identified during the public meeting and at subsequent site visits.

Breezy Point

- Nuisance flooding is associated with stormwater from a 76 acre drainage area north of the Breezy Point community. Stormwater flows from this drainage area to a culvert at Breezy Point Road. When flows are high, water can back-up onto Bayview Terrace and has caused damage to a home on this street. The culvert transports the stormwater via an underground pipe to an outfall at the end of Willow Street. The pipe discharges into the 100-year floodplain and tidal wetland adjacent to the Breezy Point Marina boat basin. At the site visit, it was determined that the culvert on Breezy Point Road is inadequately sized to accommodate the 76 acre drainage area. Additionally, a minimum of two manholes need to be installed to improve the culvert's hydraulic efficiency. The culvert must also be examined to determine if sedimentation is impeding its hydraulic efficiency.
- Nuisance flooding is associated with stormwater transgressing down Scott Street and crossing Meadow Lane. Flooding occurs in an area east of the intersection of Scott Street and Meadow Lane. A stormwater culvert lies underneath Meadow Lane beginning at the southeastern end of Scott Street for which the outfall discharges into a vegetated swale adjacent to the Plum Point Creek 100-year floodplain and tidal wetland. The impacted property owner has requested that the County dig a ditch to direct stormwater into the culvert. This has been completed. The property owner has also requested that the County clear the swale to allow stormwater to more efficiently discharge into the 100-year floodplain and tidal wetland.

Neeld Estate

- Nuisance flooding is associated with stormwater pooling at the eastern end of Ridge Road (closest to the Chesapeake Bay). A property owner reports that an asphalt curb had been installed in front of his neighbor's home. It is unclear as to whether the curb was installed by the neighbor or the County. In addition, the property owner states that the repaving of Ridge Road has raised the road, which diverts stormwater onto their property and impedes stormwater from draining off of their property. The property owner has requested that the County build an asphalt curb along their property to divert stormwater away from their property and onto Ridge Road. Note: During the public meeting, several property owners reported increased nuisance flooding associated with unmanaged stormwater due to repaving roads without milling. Milling raises the road. Calvert County typically does not mill its roads before repaving due to budgetary constraints.
- Nuisance flooding is associated with stormwater that flows from west of Ridge Road (the portion of Ridge Road perpendicular to the shore). This stormwater flows south of 2814 Ridge Road and is diverted by a rip rap swale to the property located at 2809 Ridge Road; stormwater then flows between the two properties located at 2804 Lookout Trail and 2806 Lookout Trail and eventually pools at the intersection of Knoll Road and Bay Boulevard. Erosion also occurs on properties located along Lookout Trail. Once leaving the intersection of Knoll Road and Bay Boulevard, the stormwater flows to Beach Drive and eventually into the Chesapeake Bay or the Breezy Point Marina canal.
- Nuisance flooding is associated with stormwater flowing from steep slopes north of Shore Drive, across Shore Drive and down Ridge Road, pooling at 2838 Ridge Road; it pools again along Ridge Road just north of the Ridge Road and Bay Boulevard intersection. Once leaving the intersection of

Ridge Road and Bay Boulevard, the stormwater flows to the lowest point onto Beach Drive and eventually drains into the Breezy Point Marina canal.

- Nuisance flooding is associated with stormwater flowing from west of Ridge Road (the portion perpendicular to the shore) to properties located along Bay Boulevard and Beach Drive east of Bay Parkway and Cedar Drive. This stormwater eventually drains into the Chesapeake Bay.

#2 Sewer service feasibility: Due to a high failure rate of septic systems in Breezy Point and Neeld Estate, residents ranked sewer service as its second highest flood related issue. Residents requested that the feasibility of sewer service be researched for Breezy Point and Neeld Estate.

Based on the 2014 Calvert County Comprehensive Water and Sewerage Plan (WSP), sewer service is not planned or programmed for Breezy Point and Neeld Estate. However, the WSP recognizes Breezy Point and Neeld Estate as septic system failure areas due to high groundwater and poor percolation[17]. Furthermore, the 2014 Calvert County Water and Sewerage Plan recommends several actions to address designated septic system failure areas—special criteria for septic systems or the construction of a shared community collection system[18]. The County's policy is to prioritize sewer service for areas designated with failing septic systems by the State Health Department[19]. Furthermore, Breezy Point and Neeld Estate are designated as a Rural Village under the State's Priority Funding Area Act; therefore, there is potential for property owners to receive BRF monies, up to $20,000 per home, for sewer service. The Bay Restoration Fund is a dedicated state fund to replace failing septic systems with nutrient removing septic systems, fund sewer connections for septic system failure areas as designated by the State Health Department, and to upgrade waste water treatment plants with enhanced nutrient removal capabilities. Preliminary research indicates Breezy Point and Neeld Estate potentially meet criteria to utilize a shared community collection system for sewer service. Connecting to one of the County's existing waste water treatment plants is not feasible due to distance between Breezy Point and Neeld Estate and the County's waste water treatment plants.

To obtain sewer service in an area not planned for sewer service, first residents must build consensus to pursue sewer service. Once community consensus is achieved, residents must prepare, sign and send a petition to the BOCC stating the need for sewer service (designated as a failing septic system area in the County's 2014 Water and Sewer Plan). If the BOCC considers the petition, several actions must be taken to secure sewer service. For example, actions may include a sanitary survey conducted by the Health Department to assess the number of failing septic systems for which a majority of the septic systems in each neighborhood must be failing; changing the sewer category; conducting a feasibility study (including identifying the appropriate land area to accommodate the shared community collection system and land

[17] Source: Calvert County 2014 Water and Sewerage Plan, p. 74 (website source: http://www.co.cal.md.us/DocumentCenter/View/2412).
[18] Source: Calvert County 2014 Water and Sewerage Plan, p. 74 (website source: http://www.co.cal.md.us/DocumentCenter/View/2412).
[19] Source: Calvert County 2014 Water and Sewerage Plan, p. 9 (website source: http://www.co.cal.md.us/DocumentCenter/View/2412).

application of effluent); estimating front foot assessments; programming funds into the County's Capital Improvement Plan; creating a special tax district; and possible other actions depending upon specific site characteristics and the most up-to-date regulatory requirements. Additionally, MDE will need to approve a permit for the shared community collection system. Furthermore, the community will need to enter into a third party contract for a private company to manage and operate the shared community collection system. Oftentimes, shared community collection systems are not properly maintained and revert to the responsibility of the local jurisdiction. Calvert County government prefers such systems to be maintained by a third party, private company.

Moreover, due to topography of Breezy Point and Neeld Estate, the challenges for providing sewer service include finding land to accommodate a shared community collection system and land application of the effluent; and the need for pump stations due to the slopes to the west of both communities. Lastly, funding sources will also need to be investigated including the BRF, a special tax district, bonds or a MDE low interest loan. Since Breezy Point and Neeld Estate are flood-prone and vulnerable to sea level rise, residents should also petition to obtain water service.

#3 Neeld Estate Beach Erosion: Residents ranked Neeld Estate Beach erosion as its third highest flood related issue. Neeld Estate Beach erosion is due to the natural process of littoral drift and the interplay of the current erosion control measures along Breezy Point's and Neeld Estate's shoreline. As discussed previously, according to DNR's Costal Atlas, between 1841 and 1946, Breezy Point's shoreline has eroded away—a land area approximately two street blocks in size, while Neeld Estate has experienced accretion—a land area approximately two blocks in size. To mitigate Breezy Point Beach erosion, a groin field was constructed. In addition, the Breezy Point Marina canal experiences sedimentation. To mitigate canal sedimentation, jetties were constructed at the mouth of the canal and have slowed canal sedimentation; however, periodic dredging is also necessary to further mitigate canal sedimentation. Additionally, the end of the jetty on the south side of the canal has worn away somewhat throughout the years, diminishing its ability to mitigate canal sedimentation and requiring more frequent canal dredging. Furthermore, a bulkhead, extending from the Breezy Point Marina canal to Lookout Trail, mitigates beach erosion by trapping sand between the shoreline homes and the bulkhead. The bulkhead also protects waterfront properties from wave action. There is a break in the bulkhead at the end of Ridge Road, which is a public access point to the beach for the community. Residents believe that the opening in the bulkhead diminishes the bulkhead's ability to mitigate wave action and allows tidal flood water to impact waterfront properties. Some residents have expressed the desire to close the bulkhead gap, while other residents oppose closing the bulkhead gap due to its function as a beach access point. Closing this gap on the existing bulkhead would depend on the desires of the entire community and the land owner (Calvert County). Calvert County government supports maintaining the public access to the beach.

During severe weather events such as a nor'easter, tropical storm or hurricane, wave action can transport sand onto waterfront properties and Beach Drive, and water can flow over the bulkhead and through the opening at Ridge Road where it floods Beach Drive. This water and sand eventually transports from Beach Drive into the Breezy Point Marina canal. Moreover, during these more severe weather events,

sand may erode or accrete on the "bayside" of the bulkhead. Littoral drift causes the cycle of erosion and accretion on the "bayside" of the bulkhead, which is not feasible to mitigate.

#4 Potential costs to Neeld Estate property owners to address Neeld Estate Beach erosion: Residents expressed concern regarding estimated costs to address Neeld Estate Beach erosion. Beach erosion may be addressed by transporting dredge spoils from the Breezy Point Marina canal to the Neeld Estate Beach. Neeld Estate residents are encouraged to work with the owner of the Breezy Point Marina to assess the possibility of a partnership between the Breezy Point Marina property owner and Neeld Estate residents to bring in dredge spoils to build up Neeld Estate Beach erosion.

#5 Public sewer service-will it happen? See residents' ranked priority #2 and the accompanying response.

#6 Inadequate lot sizes to accommodate septic systems: Residents expressed concern about lot size and the ability for lots to accommodate septic systems. Determining adequate lot size to accommodate a septic system involves many variables. For example, some considerations include: topography and soils; location of wells; surface water; slopes of 12 percent or more; parcel boundaries and building foundations on the parcel; the number of bedrooms in the structure; and design flow. According to the "Design and Construction Manual for Sand Mound Systems," the land area for the mound system itself ranges from 5,800 square feet to 13,300 square feet[20]. For a traditional septic system and drainage field, the land area for the septic system and drainage field is generally 20 by 50 feet unless otherwise dictated by site conditions.

The BOCC appointed a "Small-Lot Subcommittee" to investigate the potential problems caused by septic systems on small lots. The committee's recommendations were that every lot must have sufficient suitable space for one primary and two secondary drain fields and only multi-chambered septic tanks of 1,500 gallons or more would be allowed for new construction and replacement systems. Those recommendations were adopted in January 1993 and are still in force[21].

A cursory look into the lot sizes in Breezy Point and Neeld Estate indicate that typical lot sizes in Breezy Point are approximately 6,600 square feet; in Neeld Estate, lot sizes typically range from 4,085 square feet to 11,000 square feet. Given the typical lot sizes in both communities, it is possible that lot sizes of some parcels are too small to accommodate septic systems and drainage areas and/or mound systems. Note: The inadequacy of lot size may also be used as a reason to justify water and sewer service through a shared community collection system.

---

[20] Source: State of Maryland, Department of the Environment, Water Management Administration, Wastewater Permits Program, On-Site Systems Division, February 26, 2016 5th edition, page 11 (website source: http://www.mde.state.md.us/programs/Water/BayRestorationFund/OnsiteDisposalSystems/Documents/Onsite%20Systems/Sand%20Mound%20Manual.pdf.)

[21] Source: Calvert County 2014 Water and Sewerage Plan, pp. 74-75 (website source: http://www.co.cal.md.us/DocumentCenter/View/2412).

#7 Rising sea level and associated rising tidal water: Residents expressed a concern regarding the rising sea level and associated rising tidal water. As indicated by the findings made by the Maryland Climate Change Commission's 2013 report, "Updating Maryland's Sea Level Rise Projections," sea level rise, tide and storm surge are expected to increase by 2.1 feet by 2050 and 3.7 feet above sea level (minimum increase) to 5.7 feet above sea level (maximum increase) by 2100. Additionally, the tidal gauges at Solomons indicate that sea level has raised nearly one-foot between 1937 and 2014. The implications of sea level rise and the associated increased tides and storm surge call for coastal infrastructure/structure resiliency planning and flood mitigation. As discussed throughout this Plan, elevating structures and segments of roadway, and implementing stormwater management best management practices are necessary to mitigate tidal flooding and nuisance flooding associated with nor'easters, tropical storms, hurricanes and heavy/prolonged rain events coupled with tides. Rising sea level will continue to be a challenge for communities located on low-lying lands along the shoreline. Flood mitigation measures for the immediate future continue to include complying with the NFIP, purchasing flood insurance, elevating residential structures, flood-proofing nonresidential and historic structures, rehabilitation and/or new construction of shoreline erosion control measures, or retreat (demolishing a structure and allowing it to transition back to its natural state). As 2050 and 2100 approach, retreat may be the preferred option. However, if retreat is not accepted by residents and decision makers, alternative measures may be considered as discussed previously in this Plan. These measures include amphibious homes and floating communities.

#8 Lower property values due to flooding: Not many studies have been conducted assessing property values for properties located in the 100-year floodplain. The results vary depending upon when they were conducted (prior to the 2008 recession) and what geographical areas were studied. Some studies found that property values decrease in less affluent neighborhoods, while other studies found that the more affluent neighborhoods did not experience property devaluation. In the more affluent neighborhoods, property values continue to increase because households in these neighborhoods possess the disposable income to mitigate flood impacts. For Breezy Point and Neeld Estate, looking at recent sales prices from Maryland State Department of Assessment and Taxation, property values are not decreasing; therefore, it is also feasible to conclude that property values are not decreasing due to the increased coastal weather related events and their impacts.

Recommendations

The recommendations presented below are categorized into: (1) immediate and short-term actions that may mitigate flooding into the foreseeable future; and (2) long-term actions to consider mitigating for flooding and sea level rise into 2050 and 2100. Approaching 2050 and beyond, the County and the residents should establish a threshold by which traditional flood mitigation measures—i.e., elevating residential structures, flood-proofing nonresidential and historic structures, shoreline erosion control measures (groin field, jetty and bulkhead), and/or retreat (demolishing a structure and allowing it to transition back to its natural state)—are no longer desired due to widespread flooding and/or inundation, posing adverse impacts to public safety, infrastructure investments and sustainability.

Immediate and Short-Term Recommended Actions

Recommendation #1: Increase the Freeboard Requirement for New Houses and Substantial Improvements of Existing Houses Currently Located in the 100-Year Floodplain from Two Feet to Three Feet Above Sea Level to Mitigate for the 2050 Sea Level Rise Scenario, Four Feet Above Sea Level to Mitigate for the Minimum 2100 Sea Rise Level Scenario, or Six Feet Above Sea Level to Mitigate for the Maximum 2100 Sea Level Rise Scenario.

Residents and the County should consider the life of a 20-year bond or 30-year bond when making decisions about infrastructure investments such as roads that lie within the 100-year floodplain and are susceptible to flooding. This infrastructure should be designed to function to 2050 and beyond, which would include factoring in the 2050 2.1-foot sea level rise scenario. For example, the Town of North Beach is working with SHA to redesign MD 261 from the Calvert County/Anne Arundel County border to the Town of North Beach's border. MD 261 is an emergency evacuation route. Designing this portion of MD 261 to mitigate for the 2050 2.1-foot increase in sea level will increase the functionality of this emergency evacuation route for approximately the next 30 years (assuming the 2050 scenario becomes a reality). Additionally, residents should consider the life of their mortgage when deciding on flood mitigation measures. Typically, mortgages are 30 years. The 2050 sea level rise scenario has a timeline that closely mirrors the life of a 30-year mortgage at this point in time. Homeowners, if they are elevating their homes, should factor in a 2.1-foot sea level increase into their FPE.

Under current conditions, it is recommended to elevate residential structures and/or retreat (demolishing a structure and allowing the land to transition back to its natural state) within the 100-year floodplain in Breezy Point on portions of Breezy Point Road, Burgess Road, Ridge Road and Willow Street; and in Neeld Estate on portions of Bay Boulevard, Beach Drive, Lookout Trail, Ridge Road and Shore Drive.

The current FPE in both Breezy Point and Neeld Estate is four or five plus the two feet freeboard requirement, resulting in FPEs of six or seven feet above sea level. Property owners have the option and are encouraged to elevate a structure more than the FPE for longevity of the structure. Utilizing findings in the Maryland Climate Change Commission's 2013 report, "Updating Maryland's Sea Level Rise Projections," the County should consider modifying freeboard requirements to:

- Three feet to mitigate for the 2050 scenario of a 2.1-foot sea level rise,
- Four feet to mitigate for the 2100 scenario of a 3.7-foot (minimum) sea level rise, or
- Six feet to mitigate for the 2100 scenario of a 5.7-foot (maximum) sea level rise.

Additionally, if stricter freeboard requirements are in place and if the County were to seek FEMA pre-disaster flood mitigation grant monies/disaster funds to elevate structures, FEMA would fund the elevations to the higher elevation standard. Currently, FEMA will fund elevations to the two-foot freeboard requirement only.

Recommendation #2: Address Current Flood Threats by Elevating Residential Structures and/or Retreating.

Elevating residential structures and/or retreat (demolishing a structure and allowing the land to transition back to its natural state) are commonly used methods to mitigate for flooding and are appropriate in Breezy Point and Neeld Estate. Funding may be private or through FEMA's pre-disaster or disaster grant fund assistance. FEMA awards flood mitigation grants that fund 75 percent of elevation and/or acquisition/demolition costs, while the remaining 25 percent is funded by the property owner. As of 2016, the County is administering a FEMA grant to elevate three homes and acquire one property/demolish the structure and allow the land to transition back to its natural state. Three residential structures are being elevated, of which one is located in Broomes Island, and the other two are located in Cove Point. The residential structure being demolished and transitioning back to its natural state is located in Broomes Island. It is recommended that the County continue working with MEMA and FEMA to secure pre-disaster and disaster recovery flood mitigation grant funds to elevate residential structures and/or retreat.

FEMA's current policy is to award pre-disaster grant funds to severe repetitive loss properties, of which there are presently none in the County. Pre-disaster flood mitigation funding is highly competitive nationwide. Refer to Table 3 for an overview of grant programs offered by FEMA. Less competitive funds have become available through FEMA's declaration of Maryland as a disaster area due the 2016 nor'easter that dumped more than three feet of snow on the metropolitan area. In this instance, only Maryland property owners within the 100-year floodplain are competing for these grant funds; therefore, they are less competitive than pre-disaster nationwide competitive funds. The County is working with FEMA and MEMA to secure funds to elevate additional homes under the 2016 disaster declaration.

Recommendation #3: Address Tidal Overflow from the Breezy Point Canal Through Stormwater Management Measures.

As reported by the residents of Neeld Estate, tidal flooding is associated with overflow from the Breezy Point Marina canal. During high tide, overflow from the Breezy Point Marina canal makes its way onto Beach Drive. Residents report that water flows from the Breezy Point Marina canal to the property located at 2813 Beach Drive. During extreme flood events all of Beach Drive floods. It is recommended that DPW EH design and implement stormwater management measures to mitigate overflow coming from the Breezy Point Marina canal.

Recommendation #4: Address Stormwater Management Issues that Contribute to Nuisance Flooding by Conducting and Implementing a Stormwater Management Study for Breezy Point and Neeld Estate.

As discussed previously, residents reported to CPB ES and DPW EH instances of unmanaged stormwater contributing to nuisance flooding, and contributing to tidal flooding. Below are recommendations to address some of the reported nuisance flooding occurrences. Overall, it is recommended that DPW EH conduct a stormwater management study, develop a stormwater management plan and implement the plan for both communities. Funding to develop the plan will need to be identified.

Breezy Point

- Nuisance flooding is associated with stormwater from a 76 acre drainage area north of the Breezy Point community. Stormwater flows from this drainage area to a culvert at Breezy Point Road. When flows are high, water can back-up onto Bayview Terrace and has caused damage to the home located at 5030 Breezy Point Road. The culvert transports the stormwater via an underground pipe to an outfall at the end of Willow Street. The pipe discharges into the 100-year floodplain and tidal wetland adjacent to the Breezy Point Marina boat basin. At a site visit, it was determined that the culvert on Breezy Point Road is inadequately sized to accommodate the 76 acre drainage area. Additionally, a minimum of two manholes need to be installed to improve the culvert's hydraulic efficiency. The culvert must also be examined to determine if sedimentation is impeding its hydraulic efficiency. Potential actions to correct this stormwater related flooding issue include:
    - Identify and secure funding sources to conduct a stormwater management study of the drainage area.
    - Conduct an assessment to identify: (1) if the culvert is sized adequately; (2) if sedimentation is adversely impacting hydraulic efficiency; and (3) the number of manholes needed to improve hydraulic efficiency.
    - Implement stormwater management practices once adequate measures have been identified.

- Nuisance flooding is associated with stormwater transgressing down Scott Street and crossing Meadow Lane. Flooding occurs in an area east of the intersection of Scott Street and Meadow Lane. A stormwater culvert lies underneath Meadow Lane beginning at the southeastern end of Scott Street for which the outfall discharges into a vegetated swale adjacent to the Plum Point Creek 100-year floodplain and tidal wetland. The impacted property owner has requested that the County dig a ditch to direct stormwater into the culvert. This has been completed. The property owner has also requested that the County clear the swale to allow stormwater to more efficiently discharge into the 100-year floodplain and tidal wetland. Potential actions to correct this stormwater related flooding issue include:
    - Identify and secure funding sources to conduct a stormwater management study of the drainage area.
    - Investigate whether or not clearing the vegetated swale would allow stormwater to drain more quickly from this area. Note: This swale could be part of the nontidal/tidal wetland associated with Plum Point Creek; therefore, clearing the swale may require joint federal/state permit approval. Additionally, the swale is located in the Critical Area, which would require a Vegetation Removal Permit approval from the County.

Neeld Estate

- Nuisance flooding is associated with stormwater pooling at the eastern end of Ridge Road (closest to the Chesapeake Bay). A property owner reports that an asphalt curb had been installed in front of his neighbor's home. It is unclear as to whether the curb was installed by the neighbor or the County. In addition, the property owner states that the repaving of Ridge Road has raised the road, which diverts stormwater onto their property and impedes stormwater from draining off of their property. The

property owner is requesting that the County build an asphalt curb along their property to divert stormwater away from their property and onto Ridge Road. Note: During the public meeting, several property owners reported increased nuisance flooding associated with unmanaged stormwater due to repaving roads without milling. Milling raises the road. Calvert County typically does not mill its roads before repaving due to budgetary constraints.

  - Identify if the asphalt curb was installed by the neighbor or the County.
  - If the asphalt curb was installed by the neighbor, DPW EH encourages the property owner to contact their neighbor to resolve drainage issues brought about by the construction of the asphalt curb.
  - If the asphalt curb was installed by the County, the County will need to provide a solution and funding will need to be identified.

- Nuisance flooding is associated with stormwater that flows from west of Ridge Road (the portion of Ridge Road perpendicular to the shore). This stormwater flows south of 2814 Ridge Road and is diverted by a rip rap swale to the property located at 2809 Ridge Road; stormwater then flows between the two properties located at 2804 Lookout Trail and 2806 Lookout Trail and eventually pools at the intersection of Knoll Road and Bay Boulevard. Erosion also occurs on properties located along Lookout Trail. Once leaving the intersection of Knoll Road and Bay Boulevard, the stormwater flows to Beach Drive and eventually into the Chesapeake Bay or the Breezy Point Marina canal.
  - Address this nuisance flooding occurrence through conducting a stormwater management study, developing a stormwater management plan and implementing the plan. Funding to develop the plan will need to be identified.

- Nuisance flooding is associated with stormwater flowing from steep slopes north of Shore Drive, across Shore Drive and down Ridge Road, pooling at 2838 Ridge Road; it pools again along Ridge Road just north of the Ridge Road and Bay Boulevard intersection. Once leaving the intersection of Ridge Road and Bay Boulevard, the stormwater flows to the lowest point onto Beach Drive and eventually drains into the Breezy Point Marina canal.
  - Address this nuisance flooding occurrence through conducting a stormwater management study, developing a stormwater management plan and implementing the plan. Funding to develop the plan will need to be identified.

- Nuisance flooding is associated with stormwater flowing from west of Ridge Road (the portion perpendicular to the shore) to properties located along Bay Boulevard and Beach Drive east of Bay Parkway and Cedar Drive. This stormwater eventually drains into the Chesapeake Bay.
  - Address this nuisance flooding occurrence through conducting a stormwater management study, developing a stormwater management plan and implementing the plan. Funding to develop the plan will need to be identified.

Recommendation #5: Address Neeld Beach Erosion through a Partnership between Private Residential Property Owners in Neeld Estate and the Breezy Point Marina Owner.

Some private property owners in Neeld Estate would like to work with the Breezy Point Marina owner to amend the dredging permit for the Breezy Point Marina to allow for dredge sand spoils to be deposited onto the Neeld Estate Beach. If depositing dredge sand onto Neeld Estate Beach is a feasible and reasonable solution, the County encourages the private property owners to address Neeld Estate Beach erosion in this manner. Note: If the jetty on the south side of the Breezy Point Marina is built up, it may minimize the amount of sand depositing in the canal. Neeld Estate residents are also encouraged to work with the Breezy Point marina owner to extend the south side jetty to mitigate canal sedimentation.

Recommendation #6: Seek Bay Restoration Funds to Replace Failing Septic Systems for Properties located within the 100-Year Floodplain.

Residents expressed concern about failing septic systems and many residents expressed interest in receiving BRFs to replace these failing systems. Contact information was collected from interested residents and provided to the Bay Restoration Fund (BRF) Manager, (currently Steve Kullen, kullenst@co.cal.md.us or 410.535.1600 x2336). Residents were encouraged to contact the BRF Manager. As discussed previously, it is important to note that a short-term solution to addressing failing septic systems is to replace the systems with nitrogen removing system or holding tank funded by the BRF. Over the long-term, approaching 2050 and beyond, septic systems will not be a feasible solution in lower areas if these communities are to remain sustainable. Public water and sewer will be needed.

Recommendation #7: Pursue a Water and Wastewater Collection System to Address Water Supply and Sewage Treatment for Long-Term Sustainability.

Due to a high septic system failure rate in the low areas of Breezy Point and Neeld Estate, which is caused by a high water table and poor percolation, it is recommended that residents pursue sewer service. For the same reason, it is recommended that residents pursue water service even though residents do not report well issues associated with flooding. In flood-prone communities, long-term planning for public water and sewer service will be necessary to keep these communities viable and sustainable into 2050 and beyond.

The process by which water and sewer service may be obtained in an area not planned for sewer service such as Breezy Point and Neeld Estate starts with the residents building consensus to pursue water and sewer service. Once community consensus is achieved, residents must prepare, sign and send a petition to the BOCC. If the BOCC considers the petition, several actions should occur to secure water and sewer service including but not limited to: a sanitary survey to be conducted by the Health Department to assess the number of failing septic systems for which a majority of the septic systems in each neighborhood must be failing; changing the sewer category; conducting a feasibility study for providing sewer (including identifying the appropriate land area to accommodate the shared community collection system and land application of effluent) and water service; estimating front foot assessments; programming funds into the County's Capital Improvement Plan; and creating a special tax district. Additionally, MDE will need to approve a permit for the shared community collection system. Furthermore, the community will

need to enter into a third party contract for a private company to manage and operate the shared community collection system. Oftentimes, shared community collection systems are not properly maintained and revert to the responsibility of the local jurisdiction. Calvert County government prefers such systems to be maintained by a third party, private company.

Moreover, due to topography of Breezy Point and Neeld Estate, the challenges for providing sewer service include finding land to accommodate a shared community collection system and land application of the effluent; and the need for pump stations due to the slopes to the west of both communities. Lastly, funding sources, such as the BRF to provide financial assistance for sewer connections, a MDE Public Works Grant to provide financial assistance for water service costs; a special tax district, bonds or a MDE low interest loan should be investigated. Since Breezy Point and Neeld Estate are flood-prone and vulnerable to sea level rise, residents should also petition to obtain water service; hence, utilize a shared community collection system.

Note: It is acknowledged that recommendation #6 encourages property owners within the 100-year floodplain to seek BRF monies to replace failing septic systems. This is an immediate to short-term solution to address failing septic systems. At the same time, an immediate and short-term recommendation is for Breezy Point and Neeld Estate residents to pursue a shared community collection and distribution system for sewer and water service, respectively. Water and sewer service may take 10 years to secure; therefore, residents should start pursuing a shared community collection system for future use while utilizing BRF funds to address current septic systems failures.

Long-Term Recommended Actions

Recommendation #8: Consider Retreat to Mitigate for Flood and Sea level Rise Threats into 2050 and Beyond.

If sea level rise impacts and more severe weather events occur as predicted, County officials and the residents of impacted communities may want to consider retreat (demolishing a structure and allowing the land to transition back to its natural state), especially if public water and sewer and utilities cannot feasibly serve the area—financially and/or physically. Additionally, if roadways cannot continue to serve the area adequately due to frequent inundation, then retreat may be the best answer. As discussed above, FEMA grants may be used to demolish structures, acquire property and return property to its natural state.

Recommendation #9: If Retreat is not the Preferred Option into 2050 and Beyond, Consider Utilizing Amphibious Homes and Floating Neighborhood to Mitigate for Flood and Sea Level Rise Threats.

Approaching 2050 and beyond, in areas where retreat is not preferred, it is recommended that property owners and the County consider nontraditional flood mitigation measures. Instead of elevating residential structures, flood-proofing nonresidential and historic structures, retreat (demolishing a structure and allowing the land to transition back to its natural state), and/or utilizing coastal barriers in Breezy Point

and Neeld Estate, determine if amphibious homes and floating neighborhoods will adequately mitigate for flood water and sea level rise. As discussed previously in this Plan, amphibious homes rise and fall with flood water. Since the County's most flood-prone communities will likely flood more frequently and severely into the future, boardwalks, serving as sidewalks and providing access to structures may be appropriate and required to keep these communities viable. The concept of communities served by boardwalks is referred to as a floating neighborhood. See Figure 21 for an example of a floating neighborhood located in the Netherlands. These homes cost less than five percent more than a conventional home[22]. According to the County's initial research on the costs of constructing a boardwalk, it is estimated that 1,500 feet of boardwalk costs $1.5 million[23].

Figure 21: Floating Neighborhood Example #2

Website source: http://www.inspirationgreen.com/floating-homes.html

If amphibious homes and boardwalks are the chosen mitigation measures, the neighborhood should function as a safe and quality place to live. Therefore, infrastructure and public services should be provided in a manner that flooding can't adversely impact. Public water and sewer, or a shared community sewer system, utilities and centralized parking would need to be accommodated. Options would need to be explored and a shift in flood mitigation policies and regulations would need to occur. In addition, this option will require a significant investment of funds. Funding sources would also need to be identified.

Recommendation #10: Establish a Threshold for Which Traditional Flood Mitigation Actions are No Longer Considered Adequate to Address Flooding and Sea Level Rise.

It is recommended that the County, Breezy Point and Neeld Estate residents eventually establish a threshold for which traditional flood mitigation and sea level rise measures no longer maintain functionality of structures and infrastructure, deeming such investments financially irresponsible and in contrast to the intent of public safety and health goals. At this point, mitigation measures may transition from elevation, flood-proofing, retreat and coastal armoring to increased occurrences of retreat, enhancement of coastal armoring measures and the use of amphibious homes, and/or floating neighborhoods.

[22] Source: NiftyHomes.com (website source: http://www.inspirationgreen.com/floating-homes.html).

[23] Cost per foot is based upon costs associated with constructing the North Beach Boardwalk and was compiled by the Calvert County Department of Public Works.

Recommendation #11: Conduct Outreach to Elected Officials and Residents about Increased Flood-Vulnerability and Sea Level Rise.

It is recommended that Calvert County CPB ES conduct outreach to elected officials and citizens about rising sea and flood levels. Recommended actions include but are not limited to:

- Conduct an analysis which identifies all neighborhoods/communities that may be impacted by the 2050 and 2100 sea level rise scenarios using DNR's Coastal Atlas or comparable GIS interactive tool;
- Incorporate coastal resiliency planning into the Calvert County's 2010 Comprehensive Plan update and Calvert County Zoning Ordinance rewrite;
- Create a "sea level rise/inundation" page on the County's website;
- Integrate inundation into annual FEMA CRS outreach efforts; and
- Continue to educate citizens in repetitive loss areas on flood and flood mitigation issues.

Conclusion

As mentioned at the beginning of this Plan, CPB ES has written, is writing and is planning to write several small area flood mitigation plans for the County's most flood-prone communities. Utilizing DNR's Chesapeake and Coastal Communities Initiative Grant Program, CPB ES is taking a focused look at flooding, nuisance flooding and potential sea level rise impacts to these communities. CPB ES is working with the County's DPW EH and DPS EMD to identify mitigation measures to address tidal and nuisance flooding. Writing five small area flood mitigation plans (Cove Point, Broomes Island, Breezy Point/Neeld Estate, the Town of Chesapeake Beach and the Town of North Beach) has brought to light common themes in flood-prone communities such as but not limited to: inadequate stormwater management due to homes being built prior to the adoption of stormwater management regulations; areas of failing septic systems due to high water tables; flooding of roadways during storm events due to low elevations of roadway segments compared to BFEs; and more frequent and intense flooding associated with high tide. Also brought to light are challenges to addressing these common themes. For example, in some instances elevating a roadway is not feasible due to the infeasibility of stormwater management measures—a high water table and sandy soils oftentimes renders stormwater management measures ineffective. Failing septic systems may be replaced by mound systems or holding tanks, but in areas with high water tables anchoring a holding tank can prove challenging.

Calvert County's CPB ES, DPW EH and DPS EMD are working together to address flood issues raised by residents of the County's most flood-prone communities by identifying mitigation measures that will reduce flood hazards into the immediate future. In addition, CPB ES is taking this opportunity to explore potential sea level rise impacts on the County's most flood-vulnerable communities. These impacts range from the migration/expansion of wetlands and the 100-year floodplain, to the inundation of land and infrastructure currently at or above sea level. Residents, elected officials and County government should work toward protecting citizen safety and property values that may be impacted by tidal flooding by

identifying mitigation measures that will reduce flood hazards associated with the 100-year floodplain, and sea level rise and land subsidence into 2050 and beyond.

A special thanks to the following county and state staff persons who have contributed to the Breezy Point/Neeld Estate Flood Mitigation Plan (listed in alphabetical order):

- Andrew Balchin, Project Engineer, Calvert County Department of Public Works, Engineering and Highways for working with the residents on stormwater management issues including site visits.
- Danielle Conrow, Deputy Director, Calvert County Department of Public Works, Engineering and Highways for coordinating stormwater management activities for the Plan.
- Matt Cumers, Program Supervisor, LEHS, Calvert County Health Department for providing lot size criteria for mound septic systems and for providing eligibility criteria to receive Bay Restoration Fund monies for septic system connections to public or shared community sewer systems.
- Shelly Gooding, Emergency Management Specialist, Calvert County Department of Public Safety, Emergency Management Division for participating in the community meeting.
- Alfred Jeffrey, Division Chief, Department of Public Safety, Emergency Management Division for participating in the community meeting.
- Steven Kullen, Bay Restoration Funds Manager, Calvert County Department of Community Planning and Building, Environmental Section for providing eligibility criteria to receive BRF monies for septic system connections to public or shared community sewer systems.
- Ian Liong, Project Engineer, Calvert County Department of Public Works, Engineering and Highways for working with the residents on stormwater management issues including site visits, developing road improvement concepts, and reviewing the plan.
- Wayne Raither, Division Chief, Calvert County Department of Public Works, Water and Sewerage Division for providing information regarding shared community collection systems.
- Dan Williams, Deputy Director, Calvert County State Health Department for providing information about starting a petition for a shared community collection system.

Department of Community Planning and Building
150 Main Street, 3rd Floor
Prince Frederick, MD 20678
410.535.1600
pz@co.ca.md.us
http://www.co.cal.md.us/index.aspx